HYDRAULIC RESEARCH in the UNITED STATES

St. Anthony Falls Hydraulic Laboratory, University of Minnesota

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Edited by Florence L. Bain

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HYDRAULIC LABORATORIES

FOREWORD

This bulletin, Volume XI, Hydraulic Research in the United States, is the first edition to be published since 1942, when Volume X appeared. The first volume was issued by the National Bureau of Standards in 1933, and other volumes annually thereafter until 1942, when publication was discontinued because of the war. It is expected that in the future it will be issued annually.

As heretofore, the information contained in this bulletin is compiled with the cooperation of the various hydraulic and hydrologic laboratories in the United States. It contains, so far as it has been possible to collect it, a summary of research now in progress in these laboratories, as well as research which has been completed since the last bulletin was issued.

Because of the lapse of time since the last issue and the great amount of material received for this edition, it has seemed desirable to classify information somewhat differently than previously. The first section of the bulletin is devoted, as usual, to reports on current projects. Following that, the section dealing with abstracts of completed projects and references to publications has been enlarged and now includes full reports, where available, of projects which have been completed during the past five years. A new section, Laboratory Notes, has been added, in order to present up-to-date information about laboratory activities.

A new numbering system has been started, and in this edition the new project number is given first, followed by the project number formerly assigned in the case of old projects. This old number will be dropped in subsequent issues and only the new number will appear. In the section devoted to reports on completed projects, no new numbers have been assigned, but the old number, when one has previously been assigned, is given for purposes of identification.

It is emphasized again that the National Bureau of Standards does not have in its files reports or detailed information regarding the research projects reported by other organizations. Such information may be obtained from the correspondent listed under (d) or immediately following the title of the organization.

Copies of this bulletin are supplied to interested persons and organizations without charge and may be obtained by writing to the Chief, National Hydraulic Laboratory, National Bureau of Standards, Washington 25, D. C. A mailing list is maintained which includes the names of persons who have requested this service in writing. Because of the disruption of laboratory work generally during the war, the mailing list needs complete revision, and changes, corrections, and additions are solicited.

The supply of earlier bulletins is exhausted and there are no more copies for general distribution. A few copies are available to libraries only.

KEY TO PROJECTS

(a) Title of project.
(b) Project conducted for.
(c) Investigators.
(d) Correspondent.
(e) Nature of project.
(f) Purpose.
(g) Scope and method.
(h) Present status.
(i) Remarks.

CURRENT PROJECTS

ARMOUR RESEARCH FOUNDATION, Illinois Institute of Technology, Chicago 16, Ill.

(1) FLUID FLOW AND HEAT TRANSFER IN ARTIFICIALLY ROUGHENED PIPES.

(b) Research Corporation, Manitowoc Shipbuilding Corporation, Armour Research Foundation, and Illinois Institute of Technology.

(c) V. L. Streeter, R. G. Owens, R. A. Budenholzer, O. E. Teichmann.

(d) Prof. V. L. Streeter, 35 West 33rd Street, Chicago 16, Ill.

(e) Experimental for general information.

(f) To confirm the Prandtl-von Kármán velocity distribution and resistance laws in geometrically roughened pipes, and to obtain heat transfer data.

(g) Three geometrically similar roughnesses are machined into 4.5-inch aluminum tubing. Velocity distributions, pressure drops, and turbulence measurements are to be taken.

(h) Pipes now being roughened, instruments under construction.

(i) Progress reports issued quarterly.

THE BALDWIN LOCOMOTIVE WORKS, I. P. Morris Department, Eddystone, Pa.

(2) EFFICIENCY, HORSEPOWER AND CAVITATION TESTS - ADJUSTABLE BLADE, PROPELLER TYPE TURBINE MODELS.

(b) The Baldwin Locomotive Works, I. P. Morris Department.

(c) R. B. Willi, Supervising Engineer; H. J. Davis, Supervisor of Hydraulic Laboratory.

(d) H. J. Davis, Supervisor of Hydraulic Laboratory, I. P. Morris Dept., The Baldwin Locomotive Works, Eddystone, Pa.

(e) Experimental research in connection with future design of product.

(f) To improve upon turbine performance.

(g) Runners of various designs in combination with different turbine settings are being tested in a closed flume, the hydraulic gradient of which may be raised or lowered to simulate the operating conditions of a commercial prototype.

(h) Tests are in progress.

(3) EFFICIENCY, HORSEPOWER AND CAVITATION TESTS - FRANCIS TYPE TURBINE MODELS.

(b) The Baldwin Locomotive Works, I. P. Morris Department.

(c) R. B. Willi, Supervising Engineer; H. J. Davis, Supervisor of Hydraulic Laboratory.

(d) H. J. Davis, Supervisor of Hydraulic Laboratory, I. P. Morris Dept., The Baldwin Locomotive Works, Eddystone, Pa.

(e) Experimental research in connection with future design of product.

(f) To provide a complete set of model runners of modern design with a record of their performance covering the applicable range of specific speeds for Francis type turbines.

(g) Francis type turbines of different specific speeds are being tested in a closed flume, the hydraulic gradient of which may be raised or lowered to simulate the operating conditions of a commercial prototype.

(h) Tests are in progress.

BUCKNELL UNIVERSITY, Lewisburg, Pa.

(4) DEVELOPMENT OF SURFACE WAVES BY WIND.

(b) Laboratory project.

(c) D. M. Griffith, Harold Flinsch.

(d) Dr. Harold Flinsch, Dept. of Civil Engineering, Bucknell University, Lewisburg, Pa.

(e) General theoretical and experimental research.

(f) To develop a theory of the growth of surface waves under the action of wind, and to compare this theory with the results of measurements.

(g) Research leading to papers on the theories of surface wave growth, measurements in laboratory and in nature, and on the comparative results of theory and measurement.

(h) A paper on the proposed theoretical approach is in preparation, and experimental equipment is being assembled.

(i) "An experimental investigation of wind-generated surface waves." Harold v. N. Flinsch. Ph. D. thesis, University of Minnesota. May 1946.

(5) SHIP STABILITY AND ROLLING PERIOD.

(b) Laboratory project.

(c) D. M. Griffith, Harold Flinsch.

(d) Dr. Harold Flinsch, Dept. of Civil Engineering, Bucknell University, Lewisburg, Pa.

(e) General theoretical and experimental research.

(f) To develop general formulas for the measure of stability and the rolling period of ships.

(g) Exact and approximate formulas determining certain characteristics of ships, such as rolling period, metacentric height, etc., are compared with the results of experiments on ship models.

(h) Preliminary experiments have been performed on a basic model, and some of the results assembled in a brief report.

CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.

Inquiries concerning projects No. 6 to 11, incl., should be addressed to Prof. Robert T. Knapp or Dr. Vito A. Vanoni, California Institute of Technology, Pasadena, Calif.

(6) (659) MECHANICS OF SUSPENDED LOAD TRANSPORTATION.

(b) Research Division, Soil Conservation Service, U. S. Dept. of Agriculture.

(c) V. A. Vanoni, J. T. Rostron.

(e) Basic experimental research.

(f) To investigate the internal mechanics of transportation of suspended load in flowing water; the effects of the material in suspension upon the velocity distribution of the flow; the distribution of sediment in open channel flow.

(h) The study is being continued.

(i) For details of experiments and results, see "Transportation of suspended sediment by water." Vito A. Vanoni. Trans. A.S.C.E., Vol. III: 67-133. 1946.

(7) TRANSPORTATION OF BED MATERIAL LOAD.

(b) Research Division, Soil Conservation Service, U. S. Dept. of Agriculture.

(c) H. A. Einstein.

(e) Basic experimental research.

(f) To determine a general relationship between the rate of sediment movement by a stream and the hydraulic factors.

(g) Present experiments are being carried out in a closed circuit flume, 10 inches wide and 40 feet long. The procedure used follows, in a general way, that used in conventional bed load experiments, except that efforts are being concentrated on studying the relatively high rates of transportation where an appreciable amount of the material moves in suspension.

(h) The work is proceeding actively.

(i) This research may be considered an extension of the investigator's previous work on sediment movement which is outlined briefly in the following publications:

"Formulas for the transportation of bed load." H. A. Einstein. Trans. A.S.C.E. Vol. 107: 561-597. 1942.

"Bed load transportation in Mountain Creek." H. A. Einstein. U. S. Dept. of Agriculture, Soil Conservation Service, mimeograph publication, TP55. August 1944.

(8) (810) DENSITY CURRENTS.

(b) Research Division, Soil Conservation Service, U. S. Dept. of Agriculture.

(c) H. S. Bell, R. T. Knapp.

(e) Basic experimental research.

(f) To investigate density currents resulting from suspensions of fine sediments in reservoirs and to establish principles governing their behavior.

(h) A continuing project.

(i) For details of experiments and recent results, see the following publications:

"Density currents: Their mixing characteristics and their effect on the turbulence structure of the associated flow." Robert T. Knapp. Proc. Second Hydraulics Conf., Bul. 27, Univ. of Iowa Studies in Engineering: 289-306. 1943.

"Density currents as agents for transporting fine sediments." Hugh Stevens Bell. Journal of Geology, Vol. L, No. 5: 512-547. 1942.

"Some evidence regarding the kind and quantity of sediment transported by density currents." Hugh Stevens Bell. Trans. American Geophysical Union, Pt. 1: 67-73. August 1942.

"Stratified flow in reservoirs and its use in prevention of silting." Hugh Stevens Bell. U. S. Dept. of Agriculture, Misc. Pub. No. 491. September 1942.

"Sedimentation in reservoirs." Hugh Stevens Bell. (Discussion of the paper by Berard J. Witzig.) Proc. A.S.C.E., Vol. 69: 1630-32. December 1943.

"Future of Lake Mead and Elephant Butte Reservoir." Hugh Stevens Bell. (Discussion of the paper of J. C. Stevens.) Proc. A.S.C.E., Vol. 72, No. 1: 83-93. January 1946.

(9) (812) HYDRAULIC DESIGN OF EROSION CONTROL STRUCTURES BY MEANS OF MODEL TESTS.

(b) Research Division, Soil Conservation Service, U. S. Dept. of Agriculture.

(c) V. A. Vanoni, H. A. Einstein, J. T. Rostron.

(e) Experimental studies to obtain design information.

(f) To obtain design information for typical and specific structures.

(g) This project includes a number of investigations conducted by the Laboratory on Hydraulic Structures. Some of these are for particular structures and lead to findings and recommendations of interest only to one structure. Other tests cover more general investigation leading to results of more widespread interest. The procedures followed are those normally used in the hydraulic model laboratory.

(h) The project is being continued on a part-time basis.

(i) The following reports cover work under this project:

"Hydraulic design of durable structures for gulley control." Brooks T. Morris and D. C. Johnson. Trans. A.S.C.E., Vol. 108: 887-890. 1943.

"Scour control and scour resistant design for hydraulic structures." Brooks T. Morris. Trans. American Geophysical Union, Pt. I: 60-67. 1942.

(10) (1101) STABILITY OF NATURAL SEDIMENTS UNDER LOCALLY CONCENTRATED ATTACK ON FLOWING WATER.

(b) Research Division, Soil Conservation Service, U. S. Dept. of Agriculture.

(c) H. A. Einstein, V. A. Vanoni.

(e) Basic experimental research.

(f) To establish a rational basis for predicting the rate of scour of sediments and pavements at the foot of drop structures, overfall dams, and at other places where several erosion forces are active.

(g) The work has included both laboratory studies and field studies, and it is contemplated that future studies will continue along both of these lines. The laboratory studies included measurements of erosion due to jets, as well as in model stilling basins of various designs using the normal laboratory technique.

(h) This project is temporarily inactive, due to lack of staff.

(11) PIPE AND WIRE REVETMENT FOR STREAM CONTROL.

(b) Flood Control Surveys Division, Soil Conservation Service, U. S. Dept. of Agriculture.

(c) J. T. O'Brien, H. A. Einstein, V. A. Vanoni.

(e) Field and laboratory investigation.

(f) To obtain information upon which to base improvements on the design of pipe and wire revetments for streams.

(g) The study will include field observations and investigations as well as laboratory experiments. The field studies will be conducted by observing existing installations of pipe and wire revetment in the intermittent streams of Southern California and the Southwest with a view to determining the action and the effect of the various components of a revetment system. This study will be aided by an analysis of whatever practical data on flows, failures, etc., may be available in the files of the agencies responsible for the installations. The laboratory program will be designed to determine the general behavior of this type of revetment and to evaluate any modifications which are suggested by the field study. Laboratory flumes are available for this study in which flows carrying high concentrations of sediment can be circulated.

(h) The field investigation is well under way.

(12) INVESTIGATION OF WAVES AND SURGES IN THE APRA HARBOR, GUAM, MI.

(b) Bureau of Yards and Docks, U. S. Navy.

(c) R. T. Knapp, W. O. Wagner, M. Meisels.

(d) Prof. Robert T. Knapp, W. O. Wagner, California Institute of Technology, Pasadena, Calif.

(e) Experimental project to obtain design information.

(f) To obtain information on the wave and current action in Apra Harbor that will serve to guide the development of the Harbor by the U. S. Navy.

(g) Two models of the Harbor have been built. A small model on the scale of 1:960 was built in an outdoor laboratory on the campus. A model with a scale of 1:360 has been built in a larger basin at Azusa, Calif. The larger basin is housed in an airplane hangar 140 feet by 160 feet. Both model basins are equipped with wave and surge machines to reproduce conditions observed in the field. Wave heights in the model are measured with special electric depth gauges which record on an oscillograph, thus enabling wave amplitude surveys to be made of the entire model in a relatively short time.

(h) The work is proceeding actively.

(i) The work is similar in nature to an investigation made by the Institute, during the war, of the Naval Harbor at Terminal Island. Many of the techniques being used now were developed in this study, which is covered in a report by Prof. Robert T. Knapp and Dr. Vito A. Vanoni entitled "Wave and surge studies for the Navy Base", Terminal Island, California, January 1945.

(13) (821) STUDY OF PRE-ROTATION AND REVERSE FLOW AT THE EYE OF A CENTRIFUGAL PUMP.

(b) Laboratory project.

(c) R. T. Knapp, R. L. Daugherty.

(d) Prof. Robert T. Knapp, Prof. R. L. Daugherty, California Institute of Technology, Pasadena, Calif.

(e) Experimental project for student thesis.

(f) Experimental verification of the flow characteristics within a centrifugal pump, especially in the region near the impeller eye.

(h) The first series of investigations has been completed.

(i) The results are included in a report on the Bureau of Reclamation Research Program.

(14) GRAND COULEE PUMP MODEL TESTS.

(b) Byron Jackson Company.

(c) R. T. Knapp, R. L. Daugherty, A. Hollander, E. Lindros.

(d) Prof. Robert T. Knapp, California Institute of Technology, Pasadena, Calif.

(e) Experimental program to obtain design information.

(f) To determine the best pump unit for the specified varying conditions.

(g) A number of impellers and diffusers were tested to show the effect of minimum changes in design upon the sizes of the unit for a minimum specified efficiency, and on the change of maximum efficiency by these variations. The principal changes in design were in the impeller and diffuser angles.

(h) The program is proceeding actively.

(i) Reports are to be submitted after acceptance tests by the Bureau of Reclamation. These are expected to cover the performance of the final unit only.

(15) STUDIES OF CAVITATION PHENOMENA.

(b) Bureau of Ordnance, U. S. Navy.

(c) R. T. Knapp, A. Hollander.

(d) Prof. Robert T. Knapp, Director, Hydrodynamics Laboratory, California Institute of Technology, Pasadena, Calif.

(e) Basic experimental research.

(f) To investigate the basic nature of cavitation phenomena.

(g) Visual and photographic observations are made of cavitation on bodies of revolution and on other shapes, with a view to obtaining a physical picture of the cavitation phenomena. With this information, the problem will then be attacked analytically. For this work, a water tunnel with a working section of 14 inches in diameter and with a maximum velocity of 70 fps is available. Motion pictures have been taken at rates as high as 20,000 per second and equipment is being developed for materially increasing this rate. A new tunnel is also being constructed which will have the same size working section, but a maximum speed of 100 fps. The new tunnel will be unique in that provision is made to absorb air bubbles that are coming out of solution during cavitation before they are circulated so that the flow entering the working section will always be free from air. The tunnel will also make it possible to control the air content and to study its effect on cavitation.

(h) The project is progressing actively.

(16) HYDRODYNAMIC FORCES ON SUBMERGED BODIES.

(b) Bureau of Ordnance, U. S. Navy.

(c) R. T. Knapp, J. Levy, G. B. Robison, R. A. Howard, J. P. O'Neill, J. Kaye.

(d) Prof. Robert T. Knapp, Director, Hydrodynamics Laboratory, California Institute of Technology, Pasadena, Calif.

(e) Basic laboratory research.

(f) To develop basic concepts and information that will permit the prediction of the dynamic behavior of bodies moving in a fluid.

(g) Forces on bodies of different shapes and designs are measured in water tunnels and the important steady state and damping force coefficients are thus obtained. These results are then used to predict the dynamic behavior through analysis. Once this is done, a body can be designed to have the desired dynamic behavior by selecting a shape with the appropriate values of these coefficients. Three major pieces of apparatus are available for this type of study. The first is a 14-inch diameter high speed water tunnel with a maximum velocity of 70 fps, and the second is a free surface water tunnel with a working section of 20 inches by 20 inches in cross section and with a maximum velocity of about 30 fps. This apparatus is particularly suitable for determining the effect of a free surface on the dynamic forces on a submerged body. Both of these tunnels also have controlled pressure which make it possible to study cavitation and its effect on forces. The third apparatus is a launching tank where bodies can be launched from the air into the water at high speeds and the paths in the air and in the water observed photographically. The pressure of the air over the water can be controlled and its effect on the behavior of bodies during water entry studied.

(h) The project is proceeding actively.

(17) THE ANALOGY BETWEEN SURFACE SHOCK WAVES ON LIQUIDS AND SHOCKS IN COMPRESSIBLE GASES.

(b) Bureau of Ordnance, U. S. Navy.

(c) R. T. Knapp, H. A. Einstein, E. G. Baird.

(d) Prof. Robert T. Knapp, Director, Hydrodynamics Laboratory, California Institute of Technology, Pasadena, Calif.

(e) Basic experimental research.

(f) To investigate the applicability of the water analogy to the study of shocks in gases and to develop techniques for making measurements of surface shock waves on liquids.

(g) A specially built ripple tank about 4 feet wide and 6 feet long is used in these studies. Waves of different shape and intensity are produced in this tank which is normally filled to 1/2-inch depth. Observations of these waves are made visually, by still and motion pictures, and by special electric depth gauges which give a continuous record on an oscillograph.

(h) The project is progressing actively.

(i) The results of the work to date are given in report N-54 of the Hydrodynamics Laboratory entitled "Progress report of the analogy between surface shock waves and liquids and shocks in compressible gases", by H. A. Einstein and Earl G. Baird.

(18) (660) DEVELOPMENT OF A HOT WIRE VELOCITY METER FOR USE IN WATER.

(b) Research Division, Soil Conservation Service, U. S. Dept. of Agriculture.

(h) This project has been discontinued, due to lack of personnel.

UNIVERSITY OF CALIFORNIA, College of Agriculture, Division of Irrigation, Davis, Calif.

Inquiries concerning projects No. 19 to 24, incl., should be addressed to Prof. F. J. Veihmeyer, College of Agriculture, Division of Irrigation, Davis, Calif.

(19) (270) THE EFFECT OF THE DEPTH OF WATER TABLE UPON THE ABILITY OF PLANTS TO EXTRACT WATER.

(b) California Agricultural Experiment Station.

(c) L. D. Doneen, R. M. Hagan, A. H. Hendrickson, F. J. Veihmeyer.

(e) Experiment Station project.

(f) The work under this project is now designed to determine the ability of plants to survive and extract water under water-logged conditions.

(g) The tank equipment described in previous reports is still being used. The investigations have been enlarged, however, to study the diffusion of gases through soils under various soil-moisture conditions.

(h) Project is in active status.

(i) No published reports.

(20) (271) MOVEMENT OF WATER THROUGH SOILS.

(b) California Agricultural Experiment Station.

(c) L. D. Doneen, R. M. Hagan, A. H. Hendrickson, C. N. Johnston, F. J. Veihmeyer.

(e) Experiment Station project. Part of project on principles of soil moisture in relation to irrigation.

(f) The movement of water through soils is studied under various conditions and the ability of the soil to supply water to plants through capillary movement.

(g) Field and laboratory equipment is being used for these studies.

(h) Investigations are in active status.

(i) The following reports have been published:

"The determination of moisture in undisturbed soil." N. E. Edlefsen and W. O. Smith. Proc. Soil Sci. Soc. Amer. 8: 112-115. 1944.

"Use of tensiometers in measuring availability of water to plants." F. J. Veihmeyer, N. E. Edlefsen, and A. H. Hendrickson. Plant Physiol. 18(1): 66-78.

"Experts discuss various methods of orchard cultivation." F. J. Veihmeyer and A. H. Hendrickson. Almond Facts 9(3): 1,7. May-June.

(21) (272) STUDY OF HYDRAULICS OF SPRINKLING SYSTEMS.

(b) California Agricultural Experiment Station.

(c) J. B. Brown, C. N. Johnston, A. Molenaar.

(e) Experiment Station project.

(f) Determination of the characteristics of jets and the distribution of water from sprinklers.

(g) Facilities in hydraulic laboratory are being used for the study of reaction of jets.

(h) Project is in active status. This is part of a larger project on the improvement of farm irrigation systems.

(i) The following reports have been published:

"Hydraulics of sprinkling systems for irrigation." J. E. Christiansen. Trans. A.S.C.E. 107: 221-250. 1942.

"Irrigation of sugar beets by sprinkling." J. E. Christiansen. Spreckels Sugar Beet Bul. 6(5): 29, 34-5. 1942.

"Irrigation by sprinkling." J. E. Christiansen. Calif. Agr. Exp. Sta. Bul. 670. 1942.

(22) (666) STUDY OF THERMODYNAMICS OF SOIL MOISTURE.

(b) California Agricultural Experiment Station.

(c) R. M. Hagan, A. H. Hendrickson, C. N. Johnston, F. J. Veihmeyer.

(e) Experiment Station project.

(f) Studies are being made of methods of measuring soil moisture and the ability of soil to supply water to plants.

(g) To determine the availability of water to plants.

(h) Project is in active status.

(i) The following reports have been published:

"Volume-freezing-point relations observed with new dilatometer technique." Alfred B. C. Anderson and N. E. Edlefsen. Soil Sci. 54(3): 221-232. 1942.

"The electrical capacity of the 2-electrode plaster of Paris block as an indicator of soil-moisture content." Alfred B. C. Anderson and N. E. Edlefsen. Soil Sci. 54(1): 35-46. 1942.

"Laboratory study of the response of 2- and 4-electrode plaster of Paris blocks as soil-moisture content indicators." Alfred B. C. Anderson and N. E. Edlefsen. Soil Sci. 53(6): 413-428. 1942.

"Water-permeable jacketed thermal radiators as indicators of field capacity and permanent wilting percentage in soils." C. N. Johnston. Soil Sci. 54(2): 123-126. 1942.

"Field study of response of the electrical resistance of 2- and 4-electrode plaster of Paris blocks to variations in soil moisture." N. E. Edlefsen, Alfred B. C. Anderson, and W. B. Marcum. Soil Sci. 54(4): 275-279. 1942.

"Soil-moisture conditions and phenomena in frozen soils." Report of Committee on Physics of Soil-Moisture, 1941-42. N. E. Edlefsen, Chairman. Trans. American Geophysical Union, Pt. II: 356-371. 1942.

"Thermodynamics of soil moisture." N. E. Edlefsen and Alfred B. C. Anderson. Hilgardia 15(2): 31-298. 1943.

"A method of determining soil-moisture content based on the variation of the electrical capacitance of soil, at a low frequency, with moisture content." Alfred B. C. Anderson. Soil Sci. 56(1): 29-41. 1943.

"The role of the pF in the dynamics of soil-moisture." Report of Committee on Physics of Soil-Moisture, 1943-44. F. J. Viehmeyer, Chairman. Trans. American Geophysical Union, Pt. V: 699-712. 1944.

"Permanent wilting percentages of soils obtained from field and laboratory trials." A. H. Hendrickson and F. J. Veihmeyer. Plant Physiol. 20(4): 517-539. 1945.

(23) (667) HYDRAULICS OF IRRIGATION SUPPLIES IN CALIFORNIA.

(b) California Agricultural Experiment Station.

(c) M. R. Huberty, C. N. Johnston, A. Molenaar, A. F. Pillsbury, V. H. Scott, F. J. Veihmeyer.

(e) Experiment Station project.

(f) The effects of denudation of watersheds upon the water regimen of typical grazing areas in California are being studied.

(g) Experimental plots and small watersheds have been equipped with measuring devices. These experiments are being conducted under various conditions of soil, topography, and vegetation in Northern and Central California.

(h) Project is in active status.

(i) The following report has been published:

"Soil-moisture records from burned and unburned plots in certain grazing areas of California." F. J. Veihmeyer and C. N. Johnston. Trans. American Geophysical Union, Pt. I: 72-84. 1944.

See also Project No. 27 of University of California, College of Agriculture, Division of Irrigation & Soils, at Los Angeles, Calif.

(24) MEASUREMENT OF IRRIGATION WATER, AND IMPROVEMENT IN FARM IRRIGATION STRUCTURES.

(b) California Agricultural Experiment Station.

(c) J. B. Brown, C. N. Johnston, A. Molenaar.

(e) Experiment Station project.

(f) To develop and improve the design of water-measuring devices and to provide inexpensive means for determining rates of flow.

(g) Facilities of well-equipped hydraulic laboratory are being used.

(h) Project is in active status.

(i) The following reports have been published:

"The portable irrigation siphon and a new priming valve for siphons." C. N. Johnston. California Agr. Exp. Sta. Lithoprint, 4 pages. 1945.

"Irrigation wells and well-drilling methods in California." C. N. Johnston. California. Agr. Exp. Sta. Cir. 361. 1945.

"Farm irrigation structures." C. N. Johnston. California Agr. Exp. Sta. Cir. 362. 1945.

"A new portable field water meter and a new furrow water meter." C. N. Johnston. California Agr. Exp. Sta. Lithoprint, 7 pages. 1945.

"A new irrigation float meter for concrete pipe lines." C. N. Johnston. California Agr. Exp. Sta. Lithoprint, 7 pages. 1945.

"A new priming valve for portable siphons." C. N. Johnston. Agr. Engin. 27(1): 31-32. 1946.

"A new portable field water meter and new furrow water meter." C. N. Johnston. Agr. Engin. 27(1): 29-31. 1946.

"A float meter for concrete pipe irrigation system outlets." C. N. Johnston. Agr. Engin. 27(5): 228-230. 1946.

"Comparison performances of metallic and plastic siphons for irrigation." C. N. Johnston. Agr. Engin. 27(10): 469-470. 1946.

(25) (1157) PHYSICAL AND CHEMICAL FACTORS AFFECTING SOIL INFILTRATION RATES.

(b) California Agricultural Experiment Station.

(c) L. D. Doneen, M. R. Huberty, A. F. Pillsbury, F. J. Veihmeyer.

(d) Prof. M. R. Huberty, University of California, Los Angeles 24, Calif.; or Prof. F. J. Veihmeyer, College of Agriculture, Davis, Calif.

(e) Experiment Station project.

(f) To study factors affecting soil infiltration rates with particular reference to the quality of irrigation water.

(g) Numerous investigations in the field and laboratory are being conducted.

(h) Project is in active status.

(i) The following reports have been published:

"Compaction in cultivated soils." M. R. Huberty. Trans. American Geophysical Union, Pt. VI: 896-899. 1944.

"Factors in permeability changes of soils and inert granular material." Arthur F. Pillsbury and David Appleman. Soil Sci. 59(2): 115-123. 1945.

"Sulfur and ammoniacal fertilizers on light soils of Kern County." L. D. Doneen and M. A. Lindsay. Spreckels Sugar Beet Bulletin 10(5): 35, 39-40. Sept. - Oct. 1946.

"Sulfur and ammoniacal fertilizers produce acid soils in Kern County." L. D. Doneen and M. A. Lindsay. Pacific Rural Press. June 22, 1946.

See also Project No. 28 of University of California, College of Agriculture, Division of Irrigation & Soils, at Los Angeles, Calif.

UNIVERSITY OF CALIFORNIA, College of Agriculture, Division of Irrigation and Soils, Los Angeles, Calif.

Inquiries concerning Projects No. 26 to 28, incl., should be addressed to Prof. M. R. Huberty, University of California, Los Angeles 24, Calif.

(26) DRAINAGE INVESTIGATIONS IN COACHELLA VALLEY, CALIFORNIA.

(b) Present work cooperative between Coachella Valley County Water District, Coachella, Calif.; Regional Salinity Laboratory, U. S. Dept. of Agriculture, Riverside, Calif.; U. S. Bureau of Reclamation, Region III, Boulder City, Nev.; and University of California, College of Agriculture, Los Angeles.

(c) J. H. Snyder (for the District), H. E. Hayward (for the Regional Salinity Laboratory), C. L. Sweet (for the Bureau of Reclamation), M. R. Huberty and A. F. Pillsbury (for the University).

(e) Experiments on which to base future design.

(f) Drainage problems are anticipated to develop with the advent of Colorado River water for irrigation in the Valley. Purpose of investigation is to establish nature of and changes in the shallow ground water regime; to establish the horizontal and vertical permeability of the various strata within about 100 feet of the surface; and to establish the most feasible drainage methods with essential design information on each.

(g) On a grid network over the trough of the valley, a network of piezometers (observation wells) will be established. At each location, piezometers will be placed to tap each of the various independent acting aquifers found, the nature of the strata will be logged, and piezometric surfaces will be periodically measured. Experimental drainage units of various types will be installed and operated, obtaining frequent measurements of yield, effect on piezometric surfaces at various depths and at various distances from the unit.

(h) Experiments on the first experimental drainage well have been completed, which served to establish the technique for installing piezometers and logging the strata encountered, to point out deficiencies in the methods for drilling and developing such drainage wells in this locality, and to establish the permeability of one of the groups of strata encountered. Balance of work is in the planning stage.

(i) A report on the method of piezometer installation is being prepared for publication. The following report has been prepared:

"Hydrologic studies in Coachella Valley, California." M. R. Huberty, A. F. Pillsbury, and V. P. Sokoloff. University of California, Los Angeles 24, Calif. 49 pages, 6 figs, mimeographed. March 1945.

(27) HYDROLOGICAL EFFECTS OF RANGE MANAGEMENT PRACTICES.

(b) Laboratory project, but coordinated with similar work by the Station under F. J. Veihmeyer at Davis.

(c) A. F. Pillsbury.

(e) Experimental work.

(f) To evaluate the effects of brush burning for the purpose of promoting range forage on the infiltration and run-off of precipitation and on soil erosion in brush and brush grassland areas of Southern California.

(g) Plots and small watersheds are established on typical upland range land with two types of soil and two types of cover (chaparral and chamise) wherein run-off and erosion are measured. Plots and watersheds are established in pans to permit comparison of no-burning and burning, and as to the time any such effect persists. Comparative measurements of infiltration are made on burned over and unburned areas.

(h) A continuing project.

(i) No final data available. Some preliminary data procured from accidental burns have been made available to a State committee now preparing a report on the problem.

See also Project No. 23, University of California, College of Agriculture, Division of Irrigation, Davis, Calif.

(28) PHYSICAL AND CHEMICAL FACTORS AFFECTING SOIL PERMEABILITY.

(b) Laboratory project.

(c) M. R. Huberty, A. F. Pillsbury.

(e) General research project, but with practical applications in the fields of irrigation, drainage, and conservation stressed.

(f) To obtain factual data for the improvement of irrigation, drainage, and reclamation practices, and for the improvement of the efficiency of irrigation water conveyance and distribution.

(g) The work covers the general field of factors affecting permeability of soils and the forces involved, to some extent as regards saturated flow but mainly as regards unsaturated flow. Both field and laboratory work are under way. Specific factors investigated include: The effect of entrapped air on permeability; the effect of compaction upon permeability; the effect of various factors on compaction; the effects of various inorganic fertilizers, soil amendments and cultural practices on permeability; and the effects of the chemical constituents of irrigation waters on permeability.

(h) A continuing project.

(i) The following reports have been prepared:

"Solid, liquid, gaseous phase relationships of soils on which avocado trees have declined." M. R. Huberty and A. F. Pillsbury. Proc. Amer. Soc. for Hort. Sci., 42: 39-45. 1943.

"Compaction in cultivated soils." M. R. Huberty. Trans. American Geophysical Union, Pt. VI: 896-899. 1944.

"Factors in permeability changes of soils and inert granular material." A. F. Pillsbury and D. Appleman. Soil Sci. 59: 115-123. 1945.

See also Project No. 25, University of California, College of Agriculture, Division of Irrigation, Davis, Calif.

(29) FARM IRRIGATION STRUCTURES.

(b) Laboratory project. (c) A. F. Pillsbury.

(d) Prof. A. F. Pillsbury, University of California, Los Angeles 24, Calif.

(e) Experiment Station project.

(f) Improvement in the design and operating performance of farm pipe lines, control structures, and sprinkler systems.

(g) Laboratory investigation of factors affecting failure of plain concrete irrigation pipe lines, being primarily a study of the factors affecting expansion coefficients of the pipe, field testing of various devices for automatically controlling flow in concrete irrigation pipe lines; field and laboratory tests of the operating characteristics of sprinklers as regards distribution patterns and hydraulic efficiency; and field tests of the hydraulic characteristics of multiple sprinkler units.

(h) A continuing project.

(i) Essentially all work is in its initial stages.

UNIVERSITY OF CALIFORNIA, College of Engineering, Fluid Mechanics Laboratory, Berkeley 4, Calif.

Inquiries concerning Projects No. 30 to 46, incl., should be addressed to the Chairman, Department of Engineering, University of California, Berkeley 4, Calif.

(30) (1272) ARTIFICIAL ROUGHNESS IN OPEN CHANNELS.

(b) Laboratory project. (c) J. W. Johnson.

(e) Experimental investigation; undergraduate thesis.

(f) Investigation of methods to measure roughness.

(g) Experimental investigations in water channel containing various types of artificial roughness.

(h) Two theses and two publications completed since 1942.

(i) "A study of the distribution of frictional energy losses in open channels." M. E. Fuller and R. E. Graham. B.S. thesis. 1942.

"Friction losses in artificially roughened channels." A. C. Smith and C. Warren. B.S. thesis. 1943.

"Rectangular artificial roughness in open channels." J. W. Johnson. Trans. American Geophysical Union, Pt. V: 906. April 1945.

"Flow in a channel of definite roughness." Discussion by J. W. Johnson and E. A. LeRoux. Proc. A.S.C.E., Vol. 71, No. 6: 948. June 1945.

(31) (1271) STUDIES IN FLOW THROUGH POROUS MEDIA.

(b) Laboratory investigation.

(c) E. Glenbot, R. U. White, W. E. Padelford, K. S. Pister. (e) Student theses.

(f) Measurement of the critical gradient which would exist at the toe of an earth fill dam or levee.

(g) Water is forced vertically upward through a pipe packed with various sands of known porosities. Critical escape gradient is noted when quicksand condition exists.

(h) Two theses completed. Testing in progress.

(i) "Seepage studies." E. Glenbot. B.S. thesis. 1942.

"Flow conditions at a dam." R. U. White and W. E. Padelford. B.S. thesis, 1943.

The following report has been published: "Uplift pressure on dams. A symposium." M. A. Selim. Proc. A.S.C.E., December 1945.

(32) (1270) MIXING OF PARALLEL STREAMS.

(b) Previously in cooperation with A.S.C.E. Now a laboratory investigation.

(c) J. W. Johnson and others. (e) Student theses and special studies.

(f) To determine the energy loss at the junction of pipes of various sizes, junction angles, and discharge ratios.

(g) Various welded junctions of 6, 4, and 2-inch pipes have been prepared and are tested in a standard piping arrangement consisting of two pumps, orifice meters, and manometers.

(h) One thesis, several special investigations, and one publication have been completed since 1942.

(i) "The mixing of two parallel streams of water in a closed conduit." R. L. Johnson. M.S. thesis, 1942.

"Flow characteristics of rectangular open-channel junctions." E. H. Taylor. Trans. A.S.C.E., Vol. 109: 893. 1944.

(33) FLOW DURATION CURVES.

(b) Laboratory project. (c) E. Maltzman. (e) Undergraduate thesis.

(f) To prepare flow duration curves for certain stream in Southern California.

(g) Curves prepared from stream flow data published by the U. S. Geological Survey.

(h) One thesis completed.

(i) "Flow duration curves for stream in Southern California." E. Maltzman. B.S. thesis. 1943.

(34) MODEL STUDY OF BREAKWATER AT HUNTERS POINT, CALIFORNIA.

(b) Bureau of Yards and Docks, U. S. Navy.

(c) J. A. Putnam, K. J. Bermel, J. W. Johnson.

(e) A theoretical and experimental investigation.

(f) To provide information for locating breakwaters to give the maximum protection at this Navy Base against wave action from local winds, and then to determine th relative effects of silting and scouring should breakwaters be constructed.

(g) A relatively large scale model study was made to verify a theory of wave

diffraction in the lee of breakwaters. The data from these studies then permitted the breakwaters to be located in the best position for wave protection, and a second model then was made to investigate silting and scouring tendencies due to the breakwaters.

(h) Investigation in progress.

(35) OSCILLATORY WAVES.

(b) Laboratory project. (c) J. W. Boucher. (e) Graduate thesis.

(f) To obtain experimental information on the details of oscillatory waves in shallow water.

(g) Experiments will be conducted in a wave channel 60 feet long, 3 feet deep, and 1 foot wide. Wave velocity, period, length, height, mass transport and orbital velocities through depth and length of channel will be measured and compared with theory.

(h) Work in progress.

(36) MODEL LAWS FOR HYDRAULIC STRUCTURES.

(b) Laboratory research. (c) K. Y. Kam, R. Shindler. (e) Graduate theses.

(f) To obtain experimental data for the design of models of hydraulic structures.

(g) The effect of scale, absolute size and width, roughness, and other factors will be investigated in the laboratory channels which are available.

(h) Work in progress.

(37) FLOW THROUGH LEVEES BY ELECTRIC ANALOGY.

(b) Laboratory project. (c) J. H. Collart. (e) Graduate thesis.

(f) To obtain experimental data for design purposes.

(g) Flow nets for typical levee sections will be prepared in the electric analogy tank.

(h) Now in progress.

(38) STRUCTURES EXPOSED TO WAVE ACTION.

(b) Laboratory research. (c) J. H. Jones. (e) Graduate thesis.

(f) To obtain experimental data for the design and location of such shore protection works as groins, jetties, and bulkheads.

(g) Models of structures will be installed in the model basin and subjected to wave action. Variation will be made in groin spacing, wave characteristics, and sediment characteristics.

(h) Work in progress.

(39) BEHAVIOR OF TWO-PHASE FLUIDS IN POROUS MEDIA.

(b) Laboratory project. (c) J. A. Putnam, F. G. Miller, J. W. Gregg.

(e) Experimental and theoretical research; Ph.D. and M.S. theses.

(f) To determine the nature and importance of the departure from equilibrium conditions for single and multiple component fluids which move through porous media under pressure gradients and which undergo a gradual phase change during the process.

(g) Single component fluids, including water, ammonia, and propane, and a mixture of water and carbon dioxide, are made to flow through uniformly packed, unidirectional, insulated sand columns. The fluids enter as a single liquid-phase but experience a phase change as lower pressures are encountered downstream. Measurements are made of pressure, temperature, and liquid saturation as a function of distance. The theoretical investigation is being based on reaction rate considerations.

(h) Two M.S. theses completed; one Ph.D. and one M.S. thesis in progress.

(i) "The two-phase flow of ammonia in porous media." H. G. Spencer. M.S. thesis, 1945.

"Two-phase flow of water through porous media." J. J. Krauklis. M.S. thesis, 1943.

The following report has been published: "Two-phase, two-component flow in the viscous region." R. C. Martinelli, J. A. Putnam, and R. W. Lockhart. Trans. Am. Inst. of Chem. Engrs., Vol. 42, No. 4: 681. August 25, 1946.

(40) FLOW OF SOLID-GAS MIXTURE IN PIPES.

(b) Laboratory project. (c) L. Farbar.

(e) Experimental investigation to obtain design data.

(f) To determine pressure drop accompanying flow of air, containing large concentrations of ultra-fine solid particles (e.g., catalyst) through pipes, and to investigate problems of metering such mixtures.

(g) Recirculation of air and catalyst through piping containing one vertical run and two horizontal runs of different diameters. Catalyst to be metered gravimetrically as fed, air to be metered by standard nozzle.

(h) Apparatus designed and under construction.

(i) Some tentative empirical data under operating conditions available at local oil refineries.

(41) PRESSURE DROP ACCOMPANYING TWO-PHASE, TWO-COMPONENT FLOW IN PIPES.

(b) Laboratory project. (c) J. A. Putnam, F. D. McElwee.

(e) Theoretical and experimental investigations. Graduate theses.

(f) To determine the transition conditions under which the gas and/or liquid phases are flowing in viscous and/or turbulent motion or in slug flow for isothermal flow in horizontal and vertical pipes.

(g) Mixtures of air and various liquids are made to flow through tubes at various orientations. Pressure drop and fluid distribution are determined for a range of liquid and gas rates which may be controlled separately.

(h) Some theoretical work is nearly completed. Apparatus is being reconstructed with a view to determining the above-stated objectives. Five graduate theses completed.

(i) "Pressure drop accompanying two-component flow through pipes." L. M. K. Boelter and R. H. Kepner. Ind. and Eng. Chem., Vol. 31: 426-434. 1939.

"Isothermal pressure drop for two-phase, two-component flow in a horizontal pipe." R. C. Martinelli, L. M. K. Boelter, T. H. M. Taylor, E. G. Thomsen, E. H. Morrin. Trans. A.S.M.E., Vol. 66: 139-151. 1944.

"Two-phase, two-component flow in the viscous region." R. C. Martinelli, J. A. Putnam, and R. W. Lockhart. Trans. Am. Inst. of Chem. Eng., Vol. 42, No. 4: 681-705. 1946.

(42) UNSTEADY FLOW IN CONNECTING PIPES.

(b) Laboratory project. (c) R. G. Folsom.

(e) Theoretical and experimental investigation for general information.

(f) To develop calculation methods and charts for the solution of amplitude changes and phase shifts between the water elevations in two reservoirs connected by a long pipe.

(g) From theoretical considerations, a series of charts with dimensionless coordinates will be developed to give the amplitude and phase of the water surface elevation in a small gage well with respect to a large reservoir. Experimental data will be obtained from laboratory equipment and a study made of differences with respect to the theoretical values.

(h) Theoretical and experimental work partially completed.

(43) A PITOT TUBE STANDARD FOR FLOW MEASUREMENT.

(b) In cooperation with Turbine Pump Manufacturers' Assn.

(c) R. G. Folsom. (e) Design and experimental investigations.

(f) To develop a satisfactory Pitot tube and standard code for use in field testing of pumps.

(g) To design, construct, and calibrate a suitable Pitot tube and use it under a variety of conditions.

(h) Work in progress.

(44) THE SMALL WATER TUNNEL.

(b) Laboratory project. (c) R. G. Folsom, K. J. Bermel.

(e) Design and construction of experimental facilities.

(f) To provide laboratory facilities for studies on cavitation, ship propellers, current meters, etc.

(g) The design will include a measuring section of about 24 inches in diameter.

(h) Work just starting.

(45) (726) PUMP TESTING LABORATORY.

(b) Laboratory project. (c) R. G. Folsom.

(e) Research in the general field of pumping liquids.

(f) To improve design methods and performance of pumps.

(g) Theoretical and experimental investigations.

(h) Work to be started again in fall of 1947.

(i) During the war period, the only work completed on this project was the development of a special pump for the Navy.

The following report has been published:

"Pipe line flow of solids in suspension. A symposium. Effect on the characteristics of centrifugal pumps." L. C. Fairbank, Jr. Trans. A.S.C.E., Vol. 107: 1563. 1942.

(46) STUDY OF VELOCITY AND TEMPERATURE FLUCTUATIONS IN FULLY DEVELOPED AXISYMMETRIC TURBULENT FLOW OF A LIQUID.

(b) Laboratory project. (c) L. M. Grossman.

(e) Experimental and theoretical investigation.

(f) To measure velocity components and temperatures in the turbulent flow of a liquid in a tube in order to explain the mechanism of transport phenomena in fully developed axisymmetric turbulence.

(g) Velocity fluctuations will be determined by measuring the potentials induced in an electrolytic liquid cutting an A-C magnetic field and temperatures by means of a sensitive thermocouple. Spatial correlation coefficients will be found as well as the turbulence spectrum for liquid flow in a pipe, the object being the clarification of a non-isotropic turbulence theory for the axisymmetric case.

(h) Apparatus being assembled.

(i) The experimental technique is based on the method of induced potentials in a conducting liquid discussed in the following papers:

"The induction of electromotive forces in a moving liquid by a magnetic field and its application to an investigation of the flow of liquids." E. J. Williams. The Proceedings of the Physical Society, 42: 466-478. August 1930.

"Methode zur elektrischen Geschwindigkeitsmessung von Flüssigkeiten." B. Thurlemann. Helvetica Physica Acta 14: 382-419. 1941.

"An alternating field induction flow meter of high sensitivity." A. Kohn. The Review of Scientific Instruments, 16: 109-116. May 1945.

(47) GRAVITY WAVES AND RELATED PHENOMENON.

(b) Bureau of Ships, U. S. Navy.

(c) M. P. O'Brien, R. G. Folsom, J. W. Johnson, J. A. Putnam, H. W. Iversen.

(d) Bureau of Ships, Navy Dept., Washington 25, D. C.

(e) A theoretical, laboratory, and field investigation on the generation and forecasting of waves, surf conditions, measurement of waves, etc.

(f) To develop methods of forecasting wind waves and swell, surf conditions, and beach changes; measurement of wave characteristics; and make laboratory and field investigations to provide experimental checks and other information.

(g) The wave channel, model basin, and other facilities are used in the laboratory investigations. The field party obtain information along the entire Pacific Coast and cooperate with Naval vessels in obtaining information at sea.

(h) Work in progress.

(i) Approximately 225 technical, laboratory, and progress reports have been submitted to the Navy since starting this work in June 1944.

The following reports have been published:

"A summary of the theory of oscillatory waves." M. P. O'Brien, M. A. Mason, and staff of the Beach Erosion Board. Beach Erosion Board, Office of the Chief of Engineers, Technical Report No. 2. 1942.

"The effect of wall-friction on gravity waves." M. P. O'Brien and A. D. Chaffin, Jr. Trans. American Geophysical Union, Pt. I: 84. 1942.

UNIVERSITY OF CALIFORNIA, Department of Engineering, Los Angeles 24, Calif.

(48) FOG INVESTIGATION - FOG NOZZLE STUDIES.

(b) U. S. Forest Service. (c) E. H. Taylor, G. Young.

(d) L. M. K. Boelter, Dept. of Engineering, University of California, Los Angeles 24, Calif.

(e) Experimental project.

(f) To obtain specific information on the performance and behavior of certain commercially obtainable spray nozzles used in fire fighting.

(g) The immediate objective of this program is to provide data relative to the amount of water delivered at a number of predetermined pressures from a series of about one hundred test units. Information regarding the distribution of water within the spray is also obtained. This is done qualitatively by means of photographs and quantitatively by means of a specially designed sampling trap.

(h) Testing completed; report in progress.

UNIVERSITY OF SOUTHERN CALIFORNIA, Research Foundation for Cross-Connection Control, Los Angeles 7, Calif.

(49) RESEARCH FOUNDATION FOR CROSS-CONNECTION CONTROL.

(b) Laboratory project by University of Southern California.

(c) R. E. Vivian, E. M. Cloran.

(d) Research Foundation for Cross-Connection Control. Attention Robert E. Vivian, Director, University of Southern California, University Park, 3551 University Avenue, Los Angeles 7, Calif.

(e) General experimental research.

(f) To supplement and evaluate existing information on mechanical backflow prevention devices operating under constant line pressure, and related matters.

(g) Field investigation covering operation and maintenance of over 4000 backflow prevention devices already locally installed. Development of standard technique for the testing of double check valve installations; establishment of standardized laboratory and field test procedures and minimum specification requirements for backflow prevention equipment; field and laboratory research on material corrosion and deterioration, supplemental research on vacuum conditions, pipe sizing, and corrosion; industrial and domestic water pollution problems in relation to cross-connection control and back-siphonage prevention; head losses in backflow prevention equipment; maintenance of minimum pressures in distribution systems, in relation to back-siphonage prevention and cross-connection control.

(h) A year and a half has been devoted to field and laboratory research. A paper is being prepared, to be available about May 1, 1947, which will contain certain conclusions and recommendations covering field testing methods, and minimum specifications for backflow prevention devices operating under pressure.

(i) No reports or publications have been issued to date.

CARNEGIE INSTITUTE OF TECHNOLOGY, Department of Civil Engineering, Schenley Park, Pittsburgh 13, Pa.

(50) STILLING BASINS FOR DAMS.

(b) Laboratory project. (c) F. T. Mavis, L. M. Laushey.

(d) Prof. F. T. Mavis, Head, Civil Engineering Dept., Carnegie Institute of Technology, Pittsburgh 13, Pa.

(e) Graduate thesis.

(f) To determine the effect of an end sill in the formation of a hydraulic jump.

(g) Tailwater depths required to form a jump with various sills on the apron are found by experiment and compared with depths required without a sill.

(h) In progress.

COLORADO A & M COLLEGE, Civil Engineering Department, Fort Collins, Colo.

(51) (1090) FALL VELOCITY APPARATUS.

(b) Laboratory project. (c) D. F. Gunder.

(d) Dr. D. F. Gunder, Colorado A & M College, Ft. Collins, Colo.

(e) The project is an experimental study only.

(f) This project was designed to give a rough check on the effectiveness of the hydraulic sand separator project.

(g) The project required the design of an apparatus by which a direct measurement of fall velocities of sand particles in water could be measured. A graduated lucite tube was fitted with a mechanical device for dropping small quantities of sand into the tube. The fall velocity was measured by visual observation of transit of particles across the graduations with timings by a stop watch.

(h) Project inactive.

(52) (1089) HYDRAULIC SAND SEPARATOR.

(b) Laboratory project. (c) D. F. Gunder, E. F. Serr.

(d) Dr. D. F. Gunder, Colorado A & M College, Ft. Collins, Colo.

(e) The project is a combined theoretical and experimental study which, if successful, will give data suitable for model design use.

(f) It is the object of this project to devise a method of classifying sands on the basis of fall velocity in water. If a method of doing this can be devised, it will then be possible to analyze sand samples into classes according to fall velocity and finally to make up new samples scaled to any desired fall velocity.

(g) An apparatus has been designed and built which classifies sands according to fall velocity by a continuous flotation process. The process is purely dynamic in that the sand is introduced directly into the flow. Checking of the apparatus for duplication of results is nearly completed. A statistical theory of separation is being checked and a study of the behavior of the apparatus under varying Reynolds numbers is under way.

(h) Project is active.

(53) SAND TRAPS AND SLUICEWAYS.

(b) U. S. Soil Conservation Service, Colorado Agricultural Experiment Station, Colorado A & M College.

(c) R. L. Parshall.

(d) Ralph L. Parshall, U. S. Soil Conservation Service, Colorado A & M College, Ft. Collins, Colo.

(e) Experimental project for design purposes.

(f) To improve the efficiency of present designs of sand traps using vortex tubes, riffles, and deflectors, alone or in combinations. To perfect a design for sluiceways having a relatively flat grade which will efficiently transport the effluent material from sand traps to a point of disposal.

(g) Previous work with vortex tubes has demonstrated their effectiveness when the length is less than 16 feet. With lengths exceeding 16 feet, effectiveness decreases, and to provide designs for wide canals, lateral movement of bed load to vortex tubes by means of riffles and deflectors is being employed experimentally. Models are used in the laboratory which lend themselves to changes of design and permit visual study of the action attained. By introducing various sizes of sand or ground coal in measured quantities and measuring the capture, reasonable quantitative results have been obtained. Prototype sizes can be tested in part at a riverside hydraulic laboratory. Some experiments have been made in producing vortical flow in sluiceways.

(h) There have been numerous field applications of the vortex tube sand trap which have functioned satisfactorily in relatively small canals. The work still to be done is that of removing bed loads from large canals. A large trap is being contemplated for construction in 1947 near Fresno, Calif., in a canal 100 feet wide. A design has been offered employing combinations of several units based on model experiments.

(54) MEASURING DEVICE AND INTEGRATING INSTRUMENT.

(b) U. S. Soil Conservation Service, Colorado Agricultural Experiment Station.

(c) R. L. Parshall, C. H. Rohwer.

(d) Ralph L. Parshall, U. S. Soil Conservation Service, Colorado A & M College, Ft. Collins, Colo.

(e) Experimental project for design purposes.

(f) To perfect a practical, efficient and dependable combination measuring device and recording instrument of simple design and construction, whereby form delivery of irrigation water may be accurately measured and the total volume be totalized over any period of time.

(g) It is anticipated that the principle of measuring flow by means of a short tube or an adjustable tube orifice will be employed as the basis for designing and constructing an integrating instrument. The design of the integrating instrument will probably not include the element of time.

(h) No work done in 1946.

(i) Considerable work has been done in the past on an adjustable tube gate and more recently on turbine performance in short tubes.

(55) (1081) SNOW COURSE MEASUREMENTS AND FORECAST ANALYSES.

(b) U. S. Soil Conservation Service, U. S. Bureau of Reclamation.

(c) R. L. Parshall, H. Stockwell.

(d) Ralph L. Parshall, U. S. Soil Conservation Service, Colorado A & M College, Ft. Collins, Colo.

(e) Systematic measurements of depth and water content of the snow at high elevations in the mountain areas of Colorado for the purpose of forecasting the summer runoff in the main rivers of the State in the interest of irrigation, power, domestic supplies, and other uses.

(f) To supply information as to the probable water supply for the coming irrigation seasons.

(g) Measurement of depth of the water content of snow along many permanently established snow courses is made systematically throughout the winter months. Data on other attending conditions affecting runoff are also gathered. These measurements are compared with similar data obtained in previous years to establish a basis of forecasting probable spring and summer runoff.

(h) This is a continuous project with no plans for termination.

(56) MEASUREMENT OF FRICTION LOSSES IN PIPES AND FITTINGS USED IN IRRIGATION PUMPING PLANTS.

(b) U. S. Soil Conservation Service, Colorado Agricultural Experiment Station, Colorado A. & M. College.

(c) C. H. Rohwer, W. E. Code.

(d) Carl H. Rohwer, U. S. Soil Conservation Service, Colorado A. & M. College, Ft. Collins, Colo.

(e) Experimental project for preparing designs of irrigation pumping plants.

(f) To determine the losses due to friction in gate valves and check valves as a basis in choosing the proper type of these valves.

(g) Different sizes of valves are installed in the laboratory so that head losses due to friction are measured as the difference in head between the inlet and outlet. A pipe is installed through a bulkhead and losses are determined by means of hook gages as the difference in elevation between the free water surfaces on each side. A valve is then attached to the pipe without otherwise changing the conditions and the routine is repeated. Gate valve losses are determined for one-fourth, one-half, three-fourths, and full opening. Measurement of discharge is made with a standard weir. From these data friction losses for all rates of discharge are determined.

(h) Laboratory work will be completed during 1947.

(57) (1086) PHOTOGRAPHIC METHOD FOR MAKING SNOW SURVEYS.

(b) Laboratory project. (c) M. Parshall.

(d) Maxwell Parshall, Colorado A. & M. College, Ft. Collins, Colo.

(e) An experimental project for general information.

(f) To devise a more simple, quick, and economical method of snow surveying.

(g) A telephoto is made of a portion of a high mountain watershed. The percentage of area covered with snow is compared to the water content of the snow as determined contemporaneously in the vicinity by the standard method of snow surveying. The possibility of a correlation between the two factors is being investigated.

(h) Data are still being obtained. The project will be continued over a period of years to determine its reliability.

UNIVERSITY OF COLORADO, Department of Civil Engineering, Boulder, Colo.

(58) EFFECT OF LATERAL CONTRACTION OF SUPERCRITICAL FLOW.

(b) Laboratory project. (c) A. T. Ippen, J. H. Dawson.

(d) Dr. A. T. Ippen, Massachusetts Institute of Technology, Cambridge, Mass.; or Prof. John H. Dawson, University of Colorado, Boulder, Colo.

(e) Theoretical and experimental investigation for general information on the wave formation in channel contractions.

(f) To enable designers to more accurately design a contraction for a range of depths and velocities that will give a minimum disturbance and wave action in the contraction and in the channel below the contraction.

(g) A tilting flume was constructed at the Fritz Engineering Laboratory and a second flume at the University of Colorado, both of which enabled the operator to get a uniform depth and velocity entering the contraction so as to give Froude numbers from 0 to 15. Information on the water surface elevations was obtained by means of depth gages and photography. Experimental results checked the information obtained by theoretical examination of the

problem. It was found that a double reverse or S curve gave the largest waves and worst conditions for all supercritical flows, while a straight side wall would give the best flow conditions at supercritical flow and equally good results for subcritical conditions.

(h) Additional experimental results are being obtained by Mr. Dawson and a report is being written by Dr. Ippen:

(i) "An analytical and experimental study of high velocity flow in curved sections of open channels." Dr. A. T. Ippen. Thesis submitted at the California Institute of Technology in 1935.

"The effect of lateral contractions on supercritical flow in open channels." John Howard Dawson. Thesis submitted to Lehigh University in 1942.

(59) FLOW PATTERNS AROUND BRIDGE SECTIONS.

(b) Laboratory project. (c) J. H. Dawson.

(d) Prof. John H. Dawson, University of Colorado, Boulder, Colo.

(e) Experimental investigation giving qualitative results on flow patterns for general information.

(f) To determine the direction of flow and position of eddies in the flow past typical bridge sections so as to more adequately determine the aerodynamic characteristics of the superstructure and determine the scour around the piers.

(g) Two-dimensional flow is obtained by passing a streaming birefringent (in this case a colloidal suspension of California Bentonite) between plates of plexiglass. Two-dimensional models of the section to be studied are placed in the flowing fluid and the stream pattern is made visible through the use of circularly polarized light. Qualitative results only are obtained and recorded by means of still and motion pictures.

(h) Excellent still and motion pictures have been obtained, some of which have been submitted for publication.

(i) "Fluid polariscope." Fred Locher and J. N. Bradly. Hydraulic Laboratory Report No. 164, U. S. Bureau of Reclamation, Denver, Colo.

Photographs have been made showing vortex trails, eddy formation and position, and flow characteristics, using the fluid polariscope, for the following: orifice meter, venturi meter, sharp edge weir, ogee spillway, hydraulic jump, and a range of I and channel sections. Prints are available at cost upon application to John H. Dawson, Civil Engineering Dept., University of Colorado, Boulder, Colo.

COLUMBIA UNIVERSITY, Fluid Mechanics Laboratory, Department of Civil Engineering, New York 27, N. Y.

Inquiries concerning Projects No. 60 to 62, incl., should be addressed to Prof. Boris A. Bakhmeteff, Fluid Mechanics Laboratory, Columbia University, New York 27, N. Y.

(60) (1253) FLOW OF FLUIDS THROUGH GRANULAR (POROUS)MEDIA.

(b) Laboratory project.

(c) N. V. Feodoroff, Research Associate, under direction of Prof. Bakhmeteff.

(e) General theoretical and experimental research.

(f) To establish rational generalized expressions for permeability of porous beds consisting of grains of uniform or mixed size.

(g) The present phase, dealing with flow of air through beds of lead shot, sand, gravel, etc., is a continuation of the work systematically pursued since 1936 and interrupted by the war. It is anticipated that the results will furnish material permitting presentation of an integrated account of the phenomenon as a whole.

(h) A continuing project.

(i) Previous papers and discussions by Boris A. Bakhmeteff and Nicholas V. Feodoroff:

Journal of Applied Mechanics. September 1937 and June 1938.

Proceedings Fifth International Congress of Applied Mechanics, Cambridge, Mass., 1938.

Trans. American Geophysical Union, Pt. II, 1943.

(61) ELECTROMAGNETIC VELOMETER.

(b) Laboratory project.

(e) General theoretical and experimental research.

(f) To develop instrumentation and technique to record reliably and conveniently manifestations of turbulence in liquids, as well as to measure detailed velocity distributions in boundary layers, separation zones, etc.

(g) The approach is based on the method of applying the principle of electromagnetic induction, as suggested and developed by Dr. A. Kolin, Research Associate, who conducted the project from 1943 to 1945 under the general supervision of Prof. Bakhmeteff.

(h) Temporarily suspended; anticipate continuance in the near future.

(i) The following papers by Dr. A. Kolin indicate the field covered by the research:

"Electromagnetic velometry." Journal of Applied Physics. February 1944.

"An alternating field induction flow meter of high sensitivity." Review of Scientific Instruments. May 1945.

"Mercury jet magnetometer." Review of Scientific Instruments. August 1945.

(62) HYDRAULICS OF SHORT FLUMES.

(b) Laboratory project.

(c) N. V. Feodoroff, Research Associate, under the direction of Prof. Bakhmeteff.

(e) General theoretical and experimental research.

(f) Investigations aiming at disclosing the general behavior of water in short flumes with special emphasis on studying boundary layers, as well as phenomena connected with separation, formation of rollers, etc.

(g) The studies resumed since the end of the war are in continuation of a chain of individual projects, partly in the form of graduate theses, carried on systematically for over ten years and dealing with different aspects of hydraulics of broad-crested weirs, hydraulics of sluices, tailwater phenomena, hydraulic jumps, etc.

(h) Except occasional publications, referred to under (i), the results are to be presented in systematic form in a special volume at present in an advanced stage of preparation.

(i) The material has been partly presented in the following discussion by Prof. B. A. Bakhmeteff and N. V. Feodoroff, appearing in the Proc. A.S.C.E.:

"Profile curves for open channel flow." October 1942.

"Energy loss at the base of a free overfall." April 1942.

"Hydraulic design of drop structures for gully control." October 1942.

UNIVERSITY OF IDAHO, College of Engineering, Moscow, Idaho.

(63) FRICTION AND CORROSION CHARACTERISTICS OF ALUMINUM TUBING.

(b) Aluminum Company of America and laboratory project.

(c) H.Blickensderfer.

(d) Allen S. Janssen, Acting Dean, College of Engineering, University of Idaho, Moscow, Idaho.

(e) Experimental for general information.

(f) To determine friction factor for flow of water and ability of aluminum pipe to resist corrosion of natural water.

(g) Aluminum tubing of sizes from 1/2-inch to 2-inches will be tested to determine head loss due to friction for laminar and turbulent flow. Samples of the pipe will be exposed to waters of various mineral content and pH values in order to ascertain the ability of aluminum to resist corrosion.

(h) Inactive at present time.

(i) Shortage of workers and material has delayed starting of tests. Most necessary material and equipment is on hand and tests should begin within the next few months.

UNIVERSITY OF ILLINOIS, College of Engineering, Urbana, Ill.

(64) THE BACKWATER PROFILE FOR STEADY FLOW IN OPEN CHANNELS.

(b) In cooperation with the Water Resources Branch of the U. S. Geological Survey.

(c) W. D. Mitchell, W. M. Lansford.

(d) Prof. F. B. Seely, Head, Department of Theoretical and Applied Mechanics, 214 Talbot Laboratory, University of Illinois, Urbana, Ill.

(e) Experimental study to obtain general information.

(f) To obtain information on backwater profiles of different roughness and various channel cross-sections.

(g) This project is a continuation of research described under "The backwater profile for steady flow in a rectangular channel, etc.", University of Illinois, Completed Projects, page 100.

(h) Just beginning.

(65) FLOW THROUGH MANIFOLD PORTS IN A PIPE.

(b) Laboratory project. (c) W. M. Owen, W. M. Lansford.

(d) Prof. F. B. Seely, Head, Department of Theoretical and Applied Mechanics, 214 Talbot Laboratory, University of Illinois, Urbana, Ill.

(e) Theoretical and experimental.

(f) To obtain information on the flow through small ports in a pipe.

(g) Experimental work will be studied and coordinated with published information in an endeavor to solve the problem.

(h) Work in progress.

STATE UNIVERSITY OF IOWA, Iowa Institute of Hydraulic Research, Iowa City, Iowa.

Inquiries concerning Projects Nos. 69 to 78, incl., should be addressed to Prof. Hunter Rouse, State University of Iowa, Iowa City, Iowa.

(66) (316) HYDROLOGIC STUDIES - RALSTON CREEK WATERSHED.

(b) Cooperative project, Iowa Institute of Hydraulic Research, U. S. Dept. of Agriculture, U. S. Geological Survey.

(d) Prof. J. W. Howe, State University of Iowa, Iowa City, Iowa.

(h) Continuous records since 1924 of precipitation, runoff, groundwater levels, and cover. Drainage area three square miles of rolling agricultural land near east city limits of Iowa City.

(67) (317) COOPERATIVE SURFACE WATER INVESTIGATIONS IN IOWA.

(b) Cooperative project between U. S. Geological Survey and Iowa Institute of Hydraulic Research.

(d) Mr. L. C. Crawford or Prof. Hunter Rouse, State University of Iowa, Iowa City, Iowa.

(f) Continuous records of stage and discharge of Iowa streams.

(g) Standard methods on a state-wide basis.

(h) Gaging stations are maintained cooperatively and on a continuing basis.

(68) (845) STUDY OF HYDROLOGY OF RAPID CREEK.

(b) Cooperative project, U. S. Geological Survey, U. S. Weather Bureau, and Iowa Institute of Hydraulic Research.

(d) Prof. J. W. Howe, State University of Iowa, Iowa City, Iowa.

(f) To secure data for development of rainfall-runoff relations.

(h) Continuous rainfall, ground water, and runoff records since 1941.

(69) (1282) RELATION OF SEDIMENT CHARACTERISTICS TO BED EROSION.

(b) Laboratory project. (c) E. M. Laursen.

(e) Experimental project.

(f) To evaluate the general relationship between geometric and kinematic parameters of flow and the mean size and grading of the bed material for an arbitrary condition of scour.

(g) Experiments conducted in glass-walled flume 3 feet deep containing sluice gate, apron, depth control at downstream end, and measuring weir. Arbitrary geometrical proportions are kept constant during all runs, the sole variables being the rate of flow, the mean diameter and standard deviation of the sediment, and the time and depth of scour.

(h) Project barely begun prior to war now being resumed.

(70) (1283) SUPERCRITICAL FLOW IN OPEN-CHANNEL TRANSITIONS.

(b) Laboratory project in cooperation with the Committee on Hydraulic Research, Hydraulics Division, A.S.C.E .

(c) E.-Y. Hsu. (e) Analytical and experimental investigation.

(f) To determine principles of design for divergent canal sections carrying high-velocity flow.

(h) Phases dealing with lateral spreading of unconfined jets and most efficient boundary flare already completed; final phase of transition from flaring to parallel boundaries now under study.

(i) Graduate theses:

"Characteristics of supercritical flow at an abrupt open-channel enlargement." B. V. Bhoota. Ph. D. December 1942.

"Characteristics of supercritical flow at a gradual open-channel enlargement." E.-Y. Hsu. M.S. February 1946.

(71) FIRE-MONITOR INVESTIGATION.

(b) Bureau of Ships, U. S. Navy, and U. S. Coast Guard.

(c) J. W. Howe, C. J. Posey, D. E. Metzler.

(e) Experimental for design information.

(f) To increase the range and concentration of jets from fixed and portable fire monitors.

(g) The effect of the shape of the nozzle alone is studied by means of concentration measurements on jets from nozzles of different shapes mounted on a large approach section designed to reduce the turbulence of the oncoming flow. New forms of fixed and portable monitors have been constructed having large sections, miter bends, and vanes to reduce turbulence. The concentrations of the jets from nozzles and monitors are measured by a sampling device at a point 90 feet from the nozzle; these results are plotted in the form of contours of equal concentrations from which curves of percent of nozzle discharge versus area of jet are drawn. Jet ranges are compared by outdoor photographs from a fixed camera location.

(h) To be completed by June 1947.

(72) ELECTRIC ANALOGY OF FLUID FLOW.

(b) In part a laboratory project and in part for the David Taylor Model Basin, Bureau of Ships, U. S. Navy.

(c) P. G. Hubbard, M. M. Hassan. (e) Experimental investigation.

(f) To study the applicability of the method of electric analogy to the determination of pressure around bodies of revolution and along contraction nozzles.

(g) Lucite models of various boundary forms are provided with suitable contacts and mounted in a copper sulphate bath. With suitable instrumentation the voltage drop between successive contacts is determined, and used as a basis for computing the velocity and pressure distributions along the boundary. Extreme precision is required, so that accurate results are difficult to obtain; however, for faired boundaries the analogy is good and the indicated trends are reliable.

(h) Measurements have been made on hemispherical and elongated ellipsoidal head forms with cylindrical after bodies, and tests of nozzle forms have begun.

(73) MEASUREMENT OF TURBULENCE IN FLOWING WATER.

(b) David Taylor Model Basin, Bureau of Ships, U. S. Navy.

(c) M. C. Boyer, P. G. Hubbard. (e) Experimental project.

(f) To develop practical instruments for the measurement of turbulence in flowing water.

(g) Both the electromagnetic and the hot-wire methods are being studied experimentally with the goal of devising an instrument which will indicate instantaneous and root-mean-square magnitudes of all three velocity components.

(h) Project is three months under way.

(i) See Project No. 175, David Taylor Model Basin.

(74) DESIGN AND PROCUREMENT OF HYDRAULIC LABORATORY EQUIPMENT.

(b) National University of Colombia at Bogota.

(c) Institute staff. (e) Contract project.

(f) Provision of up-to-date equipment for student instruction in fluid motion and applied research in hydraulic engineering.

(g) Preliminary design called for three-story building 50 by 100 feet in plan: basement to house reservoir and measuring basin, basic machinery and shops; first floor to contain student laboratory, with 15 special items of fluid-mechanics equipment; second floor to provide research space, with towing tank, glass-walled channel, and river-model basin; third floor to include constant-level tank, offices, and classrooms. After approval by National University, detailed design of all equipment was made, followed by arrangement of contracts for its fabrication and procurement.

(h) All equipment has been designed, bids have been let, and building is partially completed.

(75) DIFFUSION OF SUBMERGED JETS.

(b) Laboratory project.

(c) M. L. Albertson, R. A. Jensen, Y.-B. Dai, D. E. Metzler.

(e) Experimental project.

(f) To provide information as to distribution of velocity and turbulence in two- and three-dimensional submerged jets.

(g) In initial phase, velocity distribution was measured in air as function of longitudinal and lateral position, velocity of efflux, and size of outlet, and results were reduced to dimensionless function; in second phase distribution of turbulence will be measured for various initial conditions.

(h) Initial phase now complete and being prepared for publication.

(76) GRAVITATIONAL PHENOMENA IN STRATIFIED FLOW.

(b) Laboratory project. (c) Institute staff.

(e) Analytical and experimental project.

(f) To provide information as to flow pattern, wave propagation, and diffusion across the interface between fluid layers of slightly different specific weight due to temperature, salinity, or suspended sediment.

(g) Studies involve generation of sub-surface waves, quantitative analysis of their celerity and qualitative observation of their instability under wind-driven surface waves; theoretical and experimental analysis of the flow pattern corresponding to propagation of an abrupt wave front; and experimental determination of diffusion across an interface due to artificially produced turbulence.

(h) First phase was completed for N.D.R.C. during war; second phase has just been explored in graduate thesis by Yih; third phase was begun before war and is now being resumed.

(i) Graduate thesis:

"Study of the characteristics of gravity waves at a liquid interface." C.-S. Yih. M.S. February 1947.

(77) STUDIES IN EVAPORATION.

(b) Laboratory project. (c) M. L. Albertson.

(e) Experimental, for thesis.

(f) To determine the effect of turbulence upon the transfer of vapor through the boundary layer.

(g) Above a porous porcelain evaporating surface set into a smooth boundary, the velocity, turbulence, and vapor profiles are measured to determine the thickness of the boundary layer and the laminar sub-layer, and the distribution of diffusivity and vapor immediately above the liquid surface. The velocity and the turbulence are measured by a hot-wire anemometer, and the vapor concentration is determined by very fine wet and dry thermocouples. The free-stream turbulence is created by a lattice screen of variable geometry placed upstream a variable distance from the evaporating surface. In an accompanying study, turbulence is also created over a free water surface by the rim of an evaporating pan, the pan sizes varying over a wide range of height, width, and freeboard ratios.

(h) In progress.

(i) This study is the experimental continuation indicated in the discussion by M. L. Albertson of paper by G. H. Hickox, "Evaporation from a free water surface", Trans. A.S.C.E., Vol III: 55, 1946.

(78) MODEL STUDY OF SANTA CECILIA PUMPING PLANT INTAKE.

(b) Rio de Janeiro Tramway, Light and Power Company, Ltd.

(c) E. M. Laursen, M. R. Carstens. (e) Experimental project.

(f) To determine means of diverting bed load of Paraiba River from intake forebay of four 40-m^3/sec pumps.

(g) A 1300-meter reach of the Paraiba has been built in concrete at a 1:75 undistorted scale. Prevailing currents and sediment movement will be determined, and a sediment-diversion structure capable of ready flushing will be devised.

(h) River model is complete and initial runs are under way.

(79) CAVITATION.

(b) David Taylor Model Basin, Bureau of Ships, U. S. Navy, and laboratory project.

(c) J. S. McNown, E.-Y. Hsu, C. A. Lamb, A. H. Abul-Fetouh.

(d) Prof. J. S. McNown, State University of Iowa, Iowa City, Iowa.

(e) Experimental project supplemented by theoretical studies.

(f) To give basic design information on pressure distribution around systematically-varied boundary forms under various degrees of cavitation.

(g) Tests are conducted in a 13-inch variable pressure water tunnel. Measurements are made using 1-inch models to determine effect of variation in boundary form, Reynolds number, and degree of cavitation upon the pressure distribution around two- and three-dimensional boundaries. The boundary forms to be tested include the ellipsoidal, conical, and rounded head forms - from elongated to blunt and concave - at various angles of yaw; conical and rounded tail forms; and strut and propeller sections. A second water tunnel is to be constructed for the two-dimensional forms. Additional tests are being conducted in a small water tunnel on the cavitation at gate slots for various combinations of slot dimensions and radius of rounding of the downstream edge of the slot, the experiments being compared with similar studies in a small air tunnel.

(h) A bulletin is being prepared describing the preliminary tests and the various head forms at zero angle of yaw. The study of yaw-angle effect and design of the water tunnel for essentially two-dimensional flow problems are under way. The experimental work on the study of cavitation at a gate slot is partially complete and will be the subject of a thesis to be complete in June 1947.

(80) TURBULENCE BEHIND SCREENS.

(b) David Taylor Model Basin, Bureau of Ships, U. S. Navy.

(c) M. L. Albertson, P. G. Hubbard, E. G. Petersen, D. R. Bianoo.

(d)Prof. J. S. McNown, State University of Iowa, Iowa City, Iowa.

(e) Experimental project.

(f) To study the energy loss due to flow through screens and the scale, intensity, and decay of the resulting turbulence.

(g) Screens are formed of bar lattices and of uniformly perforated plates with systematic variation of scale and area proportions. The pressure drop across these screens and scale and intensity of the turbulence at various distances downstream are measured in a low-velocity air tunnel. Three different techniques of measuring turbulence are used: hot-wire anemometer, heat diffusion, and gas diffusion. A comparison between results in air and water is planned.

(h) Measurements of pressure drop and turbulence have been made for several screens of each type. A hot-wire anemometer has been devised which reads intensity of turbulence directly, and correlation of the different methods of measurement is in progress.

(i) See Project No. 175, David Taylor Model Basin.

(81) MATHEMATICAL ANALYSIS OF PRESSURE DISTRIBUTION.

(b) Laboratory project combined with studies conducted for the David Taylor Model Basin, Bureau of Ships, U. S. Navy.

(c) J. S. McNown, E.-Y. Hsu, C. S. Yih.

(d) Prof. J. S. McNown, State University of Iowa, Iowa City, Iowa.

(e) A theoretical analysis of flow around various boundary forms.

(f) To advance the application of analytical methods to design procedure and to obtain information for specific problems.

(g) The pressure distributions around faired boundary forms are obtained mathematically, assuming that viscous effects are negligible. Both exact and approximate methods are used, and wherever possible the results are compared with experimental measurements determined in other studies. The study includes ellipsoidal and hemispherical head forms with cylindrical after bodies, two-dimensional wedge shapes with various nose angles, two-dimensional faired struts, and nozzle forms. The methods of hydrodynamics, including modifications of the approximate source-sink method presented by von Kármán, are utilized.

(h) Computations for wedge shapes of various angles and representative computations for several boundary forms have been completed. A tentative nozzle design is partially complete.

(82) HYDRAULICS OF MANIFOLDS.

(b) Laboratory project sponsored by the Committee on Hydraulic Research, Hydraulics Division, A.S.C.E.

(c) J. S. McNown, J. R. Barton, S. M. Niaz.

(d) Prof. J. S. McNown, State University of Iowa, Iowa City, Iowa.

(e) Experimental studies conducted as theses by graduate students.

(f) To obtain a better understanding of divided and confluent flow, and to provide basic design information for inflow and outflow manifolds.

(g) Tests are conducted in a 2-inch smooth brass pipe with a single right-angle lateral to determine the effect of discharge ratio and diameter ratio upon the changes in pressure at the junction, for both divided and confluent flow. Piezometer connections along the three sections of pipe make possible the determination of the significant pressure changes. The effect of spacing in multiple lateral manifolds, and the pattern of flow and pressure variation in the immediate vicinity of the junction are to be studied.

(h) The study of a single-lateral divided-flow manifold has been completed and presented in thesis form and the study of confluent flow is under way.

(i) The paper, "Lock manifold experiments" by Edward Soucek and E. W. Zelnick, Trans. A.S.C.E. 1945: 1357, contains a similar study applied specifically to lock manifold design.

A partial summary of the experimental work is contained in the following graduate thesis:

"A study of diverging flow in pipe lines." J. R. Barton. M.S. August 1946.

(83) DETERMINATION OF PRESSURE DISTRIBUTION CAUSED BY FLOW OF AIR OVER A SERIES OF TWO-DIMENSIONAL ROOF FORMS.

(b) Laboratory project. (c) G. A. Austin.

(d) Prof. J. W. Howe, State University of Iowa, Iowa City, Iowa.

(e) Experimental, for thesis.

(f) To determine pressure distribution on roofs of various slopes.

(g) Experiments in small air tunnel; maximum wind velocities approximately 70 fps; models about 3 inches in height.

(h) In progress; completion expected June 1947.

(84) RELATION OF PITOT-TUBE PROPORTIONS TO VELOCITY INDICATION IN WATER JETS.

(b) Laboratory project. (c) Y. C. Shen.

(d) Prof. J. W. Howe, State University of Iowa, Iowa City, Iowa.

(e) Experimental for thesis.

(f) Determination of errors inherent in Pitot tube used to measure discharge of water jets in air.

(g) Effect of size of tube in relation to apparent velocity distribution resulting from traverse of a jet is studied. Three sizes of tubes used, 0.03, 0.06, and 0.12 inch inside diameter.

(h) In progress.

(85) SYNTHESIS OF THE FLOOD HYDROGRAPH ON RALSTON CREEK, IOWA.

(b) Laboratory project. (c) M. R. Carstens.

(d) Prof. J. W. Howe, State University of Iowa, Iowa City, Iowa.

(e) Theoretical, for thesis.

(f) Determination of elements of rainfall contributing to runoff in selected storms on Ralston Creek.

(g) Runoff divided according to distance of contributing area from control, assumptions made as to rates of travel and storage, integration of various elements of flow made to produce synthetic hydrograph which is compared with actual hydrograph.

(h) In progress.

(86) UNSTEADY FLOW PROBLEMS FROM MASSAU'S LINE OF ATTACK.

(b) Laboratory project. (c) P.-N. Lin.

(d) Prof. C. J. Posey, State University of Iowa, Iowa City, Iowa.

(e) Theoretical, for Master's thesis.

(f) To develop a step method for computing unsteady flow problems, taking into account the theoretical considerations pointed out by J. Massau.

(g) A computation method will be devised and tested on actual problems in comparison with methods given by Thomas and others.

(h) In progress.

(87) VORTEX OVER OUTLET.

(b) Laboratory project. (c) H.-C. Hsu.

(d) Prof. C. J. Posey, State University of Iowa, Iowa City, Iowa.

(e) Experimental, for Master's thesis.

(f) To initiate study of the effect of the vortexes that form over outlets in decreasing the discharge through the outlet.

(g) Water will be introduced tangentially and radially, in controlled proportions, into a 6-foot diameter tank having a 4-inch standard orifice at the center of its smooth level bottom. Heads can be varied up to about 2 feet.

(h) Apparatus designed and being built.

(i) Only known previous work is the application suggested by J. C. Stevens, and described in Civil Engineering, August 1946: 358.

(88) A LENGTH CRITERION FOR THE HYDRAULIC JUMP.

(b) Laboratory project. (c) B. Behera, A. A. Qureshy.

(d) Prof. C. J. Posey, State University of Iowa, Iowa City, Iowa.

(e) Experimental, for Master's thesis.

(f) To develop a criterion for the length of the hydraulic jump that is closely related to bottom scour, but easy to perform, and which will give results that are not much affected by the judgment of the observer.

(g) Tests of jumps in the one-foot and three-foot flumes of the Iowa Institute of Hydraulic Research, with the potential scour intensity indicated by the point where right circular cylinders of different densities, placed on the horizontal floor of the flume, will just topple.

(h) Preliminary tests based on toppling of small brass cylinders with lead cores of different radii have been completed, and thesis written. Difficulty encountered in lack of range of higher specific gravities of cylinders. Further tests planned for appendix to thesis.

Graduate thesis: "A length criterion for the hydraulic jump." B. Behera and A. A. Qureshy. M.S. February 1947.

(194) A STUDY OF METHODS USED IN MEASUREMENT AND ANALYSIS OF SEDIMENT LOADS IN STREAMS.

Report on this cooperative project given under Project No. 194, War Department, Corps of Engineers, St. Paul District.

LEHIGH UNIVERSITY, Department of Civil Engineering, Bethlehem, Pa.

Inquiries concerning Projects No. 89 to 92, incl., should be addressed to Mr. Hale Sutherland, Director, Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa.

(89) CROSS-OVER RESEARCH ON MULTI-STAGE CENTRIFUGAL PUMPS.

(b) Ingersoll-Rand Company. (c) W. F. Hiltner.

(e) Experimental tests for design purposes.

(f) To increase pump efficiency, obtain design data.

(g) Efficiency is measured and compared for pumps with various types of cross-overs.

(h) Testing is in progress.

(90) STUDIES OF PRESSURE VARIATION CAUSED BY BOUNDARY MISALIGNMENT IN THEIR RELATION TO CAVITATION IN HYDRAULIC STRUCTURES.

(b) A.S.C.E. Sub-committee on Cavitation.

(c) W. F. Hiltner, R. E. Crispen, D. W. Appel.

(e) Experimental determination of pressure variation as function of velocity, velocity head, Reynolds number, Froude number. Correlation and checking of what theoretical aspects may be discovered.

(f) To indicate misalignment tolerance in inspection of hydraulic structures.

(g) Pressure is measured in bottom of open channel which has various transverse steps. Velocity, depth, size, and shape of steps are varied.

(h) Progress report to Sub-committee, January 16, 1946.

(91) EFFECT OF REMOVING BOUNDARY LAYER ON DRAG OF CIRCULAR CYLINDER.

(b) Laboratory project. (c) D. W. Appel.

(e) Experimental data for general information; student thesis.

(f) To explore effects of removal of boundary layer upon coefficient of drag in submerged flow.

(g) Experiments performed with water in open channel with cylinder parallel to surface. Measure drag and its variation with changing Reynolds number, quantity sucked away, and attitude of slots relative to the flow. Cylinder 1-inch diameter by 7.5 inches length. End effects probably serious.

(h) Tests in progress.

(92) FRICTION FACTOR FOR COAL SUSPENSION.

(b) Laboratory project. (c) Amnuay Phoonphiphutana.

(e) Experimental data for design of pipes and pumps for transportation of coal suspension; student thesis.

(f) Measure friction factor for straight length of horizontal pipe carrying suspension of screened coal of uniform size, as function of coal concentration, settling velocity, and Reynolds number.

(g) Calibrated pipe is inserted into flow circuit for screening tests for coal. Head loss is measured with differential manometer. Rate of discharge and sampling of concentration obtained from small section of total flow.

(h) Tests in progress.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Department of Mechanical Engineering, Cambridge 39, Mass.

(93) RECOVERY FACTORS IN WATER.

(b) Laboratory project, for thesis. (c) Professors Keenan and Kaye.

(d) Prof. Joseph H. Keenan, Room 1-202, Mass. Institute of Technology, Cambridge 39, Mass.

(e) Experimental work on flow of water at different temperatures through a tube of circular cross-section.

(f) To study experimentally the effect of Prandtl number on the recovery factor.

(g) Water at various temperatures flows through a circular tube. The surface temperature of the tube was measured and the mean temperature of the water was calculated from the measured pressure distribution. Recovery factors could then be compared with the values predicted theoretically.

(h) The experimental work has been completed and a paper will be prepared at some later date.

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(94) FLOW OF METASTABLE WATER THROUGH NOZZLES AND ORIFICES.

(b) Laboratory project. (c) Professors Keenan and Kaye.

(d) Prof. Joseph H. Keenan, Room 1-202, Mass. Institute of Technology, Cambridge 39, Mass.

(e) Experimental investigation of metastability of liquid water.

(f) To study the region of metastability of liquid water as it flows through a nozzle or orifice.

(g) Hot liquid water at pressures somewhat greater than saturation pressure was allowed to flow through a nozzle or orifice. The rate of flow of the water, the temperature and pressure before the nozzle, and the pressure after the nozzles were measured. The measured flow was compared with the theoretical flow for isentropic expansion. From these data it was planned to determine the limit of the metastability of the liquid water.

(h) Experimental data have been obtained.

(95) HYDRAULIC ANALOGUE TO FLOW OF A COMPRESSIBLE GAS.

(b) Bureau of Ordnance, U. S. Navy Dept. (c) Prof. A. H. Shapiro.

(d) Prof. A. H. Shapiro, Mass. Institute of Technology, Cambridge 39, Mass.

(e) Primarily experimental, but with secondary purpose of verifying theoretical concepts. Now being carried on in form of student theses.

(f) To derive information on the high-speed flow of gases from measurements on water flowing in a channel with a free surface.

(h) In early stages, with no definite results as yet.

(96) MEASUREMENT OF FRICTION COEFFICIENTS NEAR THE ENTRANCE OF PIPES.

(b) National Advisory Committee for Aeronautics. (c) Prof. A. H. Shapiro.

(d) Prof. A. H. Shapiro, Mass. Institute of Technology, Cambridge 39, Mass.

(e) Experimental project.

(f) To measure friction coefficients in the entrance region of a pipe, where the velocity profile is changing, and to determine the effect of Reynolds number and of turbulence.

(h) Some preliminary results obtained which indicate a qualitative similarity to the flow over a flat plate for a short distance from the entrance. Friction coefficients near entrance found to be much higher than in region of stable velocity profile.

UNIVERSITY OF MICHIGAN, Department of Civil Engineering, Ann Arbor, Mich.

(97) BEACH EROSION CONTROL.

(b) Michigan Department of Conservation. (c) E. F. Brater, J. D. Caufield.

(d) C. O. Wisler, 322 W. Engineering Bldg., University of Michigan, Ann Arbor, Mich.

(e) Experimental project.

(f) To determine the most economical and practical method of shore protection.

(g) In a large wave tank, studies will be conducted to determine the relative effectiveness of various types of revetments, open and submerged groins, and perhaps other methods that may be employed for the prevention of beach erosion.

(h) To be started July 1, 1947.

(i) This will be the first project to be started in the new Lake Hydraulics Laboratory. As a preliminary, a careful investigation is being made to determine the nature, extent, and results obtained from previous researches in this field. This preliminary study will be completed before any model studies are started. At that time, it is planned to issue a bulletin giving a bibliography of work that has been and is now being done in this field, and also a statement of the objectives which it is hoped to accomplish.

UNIVERSITY OF MINNESOTA, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

Inquiries concerning Projects No. 98 to 110, incl., should be addressed to Dr. Lorenz G. Straub, Director, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn. Inquiries concerning Projects No. 111 to 114, incl., should be addressed to Mr. Fred W . Blaisdell, Soil Conservation Service, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

(98) FLOW OF SUSPENDED SOLIDS IN PIPES.

(b) Standard Oil Company of Indiana. (c) H. D. Purdy, Jr.

(e) Research under the Standard Oil Company (Indiana) Fellowship Award.

(f) To study the effect of size of suspended matter and viscosity of fluid in flow of suspended solids in pipes.

(h) Just begun.

(99) HYDRAULICS OF CULVERTS.

(b) Minnesota Department of Highways in cooperation with U. S. Public Roads Administration.

(c) L. G. Straub, W. W. DeLapp, C. L. Larson.

(e) Experimental investigation for general information on highway culverts.

(f) To develop practical inlets and outlets for culverts which will be more efficient hydraulically than those in present use.

(g) Model studies will be made of various size culverts with different lengths and slopes under all possible flow conditions, using a wide variety of inlets and outlets. Large scale tests will be made of commercial types and of types shown superior by the model tests.

(h) Apparatus in initial stages of construction.

(100) HIGH VELOCITY FLOW IN OPEN CHANNELS.

(b) In cooperation with the Committee on Hydraulic Research, A.S.C.E .

(c) L. G. Straub, W. W. DeLapp.

(e) General research and Ph.D. thesis, experimental study.

(f) To measure the amount of air entrained in water flowing at high velocities and its effects on resistance coefficients.

(g) Observations have been made in a channel 1-foot wide and 40 feet long, with slopes up to 44° and three types of boundary roughness.

(h) Report in preparation.

(101) LONGITUDINAL VELOCITY DISTRIBUTION IN A TRIANGULAR CHANNEL.

(b) Master's thesis, University of Minnesota. (c) H. D. Purdy, Jr.

(e) Experimental and analytical student thesis.

(f) To determine longitudinal velocity distribution in a triangular channel.

(g) To determine longitudinal velocity distribution in a 6-inch, 90° triangular open channel, using kerosene as a fluid. Experiments are conducted in both the laminar and turbulent range using a Pitot tube. Results will be correlated with modern concepts of flow.

(h) Nearing completion.

(102) VELOCITY DISTRIBUTION AND BOUNDARY SHEAR IN OPEN CHANNELS.

(b) Master's thesis, University of Minnesota. (c) J. S. Holdhusen.

(e) Experimental and analytical.

(f) To determine the effect of boundary shear on velocity distribution.

(g) Velocity patterns will be determined over discharge area of a rectangular steel channel 3 feet wide and 15 inches deep at slopes greater and less than critical. Boundary shear distribution will be determined by the Kármán theory of turbulence.

(h) Experiments are about to begin.

(103) EXPERIMENTAL AND ANALYTICAL STUDIES OF THE MECHANICS OF MOVEMENT OF SEDIMENTATION ALONG STREAM BEDS.

(b) The Engineering Foundation in cooperation with the A.S.C.E..

(c) L. G. Straub, L. W. Neubauer.

(e) An experimental and analytical study of fundamental nature.

(f) To expand earlier studies of mechanics of bed sediment movement with particular emphasis on the influence of the mechanical properties of the fluid.

(g) A recirculating system involving temperature control apparatus, sediment supply system, sediment trap and a test section, of 12 inches width, 24 inches depth, and 42 feet length will be tested with a variety of fluids and sediments over a wide temperature range.

(h) Planning stage.

(104) FLOW DIVERSION RESEARCH.

(b) David Taylor Model Basin, U. S. Navy Dept.

(c) A. G. Anderson, E. Silberman.

(e) General theoretical and experimental research.

(f) To analyze, integrate and extend the present knowledge of fundamental mechanics of diverting fluid flow streams with special emphasis on the use of guide vane systems.

(g) American and foreign literature will be collected, translated, abstracted, and summarized. Summary will determine extent of theoretical and experimental studies to be pursued. Pilot studies of general techniques and methods of flow delineation to be carried on in parallel with literature search.

(h) Bibliography and summary report nearing completion. Pilot studies are well under way.

(105) WATER TUNNEL DESIGN STUDIES.

(b) David Taylor Model Basin, U. S. Navy Dept.

(c) J. F. Ripken, L. G. Straub. (e) Experimental check of design.

(f) To determine and improve design characteristics of a proposed 60-inch diameter, closed jet, high speed cavitation or water tunnel.

(g) A 1:10 scale model (6-inch jet diameter) constructed of metal will be tested to determine flow characteristics, design deficiencies, and operating techniques necessary to the procurement and use of the proposed prototype tunnel.

(h) Model tunnel under construction.

(i) See Project No. 175, David Taylor Model Basin.

(106) INVESTIGATION OF A MODEL SEDIMENTATION BASIN.

(b) Master's thesis, University of Minnesota.

(c) B. K. Banerjee. (e) Experimental investigation.

(f) To determine the governing model law and efficiency of operation of a sedimentation basin.

(g) Determine the distribution and sizes of sediment deposited in various parts of the basin for different conditions of operation. Glass spheres from 10 to 60 microns in diameter will be used for sediment.

(h) Experiments are about to begin.

(107) CHIPPEWA RESERVOIR SPILLWAY MODEL.

(b) Northern States Power Company. (c) L. G. Straub, W. W. DeLapp.

(e) Experimental model study.

(f) To establish optimum design of changes in existing structure for the purpose of decreasing downstream erosion.

(g) Flow and erosion patterns studied for various designs in a three-dimensional model constructed to a scale of 1;24 for a complete range of discharges.

(h) Near completion.

(108) LARGE SCALE CULVERT STUDIES.

(b) American Concrete Pipe Assn. (c) L. G. Straub.

(e) Experimental study of hydraulics of commercial culvert types.

(f) To establish entrance losses and pipe friction losses in culverts flowing at various capacities and heads, full and partly full.

(g) 24-inch culverts, 200 feet long, are constructed successively into the main testing channel of the St. Anthony Falls Laboratory and observations are made of head losses for various rates of discharge.

(h) Experiments have been begun on a 24-inch concrete culvert, 200 feet long, set at a slope of 0.2 percent.

(109) MODEL STUDY OF THE DESIGN OF A WATER SOFTENING TANK.

(b) Standard Oil Company of Indiana.

(c) L. G. Straub, J. E. Fant. (e) Commercial research.

(f) To determine the most efficient design and location of an inner effluent cone in a gravity system settling tank.

(g) Tests made using glass spheres (12 to 60 microns in diameter) and determining results quantitatively as to the efficiency of the tank.

(h) Report in preparation.

(110) EFFECT OF VISCOUS FORCES ON EFFICIENCY OF WATER SOFTENING TANK.

(b) Master's thesis, University of Minnesota.

(c) J. E. Fant. (e) Master's thesis.

(f) To determine in a model of a settling tank the influence of viscous forces on turbulence and efficiency by using idealized glass spheres as sediment.

(g) Tests to be made in a model with results as to the efficiency to be determined quantitatively and qualitatively from samples of the effluent.

(h) Equipment completed.

(111) DROP INLET CULVERT WITH PIPE CONDUIT.

(b) Division of Drainage and Water Control, Soil Conservation Service, U. S. Dept. of Agriculture, in cooperation with Minnesota Agricultural Experiment Station.

(c) S. H. Anderson, F. W. Blaisdell. (e) For design purposes.

(f) To obtain data on the hydraulic performance, discharge, and pressures.

(g) The tests will cover the complete range of conditions encountered in the field. Data will be obtained for several types of drop inlet and for pipes laid on both steep and flat slopes. Results will be reduced to the simplest possible form. Tests are in progress. Some results have been obtained.

(h) Study in progress.

(i) The pipe drop inlet culverts laid on steep slopes (1 on 3) flow completely full when the outlet discharges freely.

"Preliminary results of tests on pipe bleeders laid on steep slopes." Fred W. Blaisdell. November 1942. This publication is available for loan by writing to the Project Supervisor, Soil Conservation Service, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

(112) DROP SPILLWAY WITH BOX INLET.

(b) Division of Drainage and Water Control, Soil Conservation Service, U. S. Dept. of Agriculture, in cooperation with Minnesota Agricultural Experiment Station.

(c) F. W. Blaisdell, C. A. Donnelly. (e) To develop a generalized design.

(f) To obtain discharge coefficients and other information required for the design of box inlet drop spillways.

(g) Experiments are run on models to determine the effect of different length to width ratios, height of drop, channel width, dike location, submergence, etc., on the discharge curves.

(h) Some results have been obtained. Tests are now under way.

(i) "The hydraulic design of rectangular spillways." Albert N. Huff. October 1943. This publication is available for loan by writing to the Project Supervisor, Soil Conservation Service, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

(113) OUTLET FOR BOX INLET DROP SPILLWAY.

(b) Division of Drainage and Water Control, Soil Conservation Service, U. S. Dept. of Agriculture, in cooperation with Minnesota Agricultural Experiment Station.

(c) C. A. Donnelly. (e) To develop a generalized design.

(f) To develop a satisfactory outlet structure for box inlet drop spillways.

(g) The design will be general and dimensionless so that the outlet can be applied to any size of box inlet drop spillway or any discharge. Empirical methods were used to develop the outlet.

(h) Study completed; report being prepared.

(114) DIVERGING TRANSITIONS FOR SUPERCRITICAL VELOCITIES.

(b) Division of Drainage and Water Control, Soil Conservation Service, U. S. Dept. of Agriculture, in cooperation with Minnesota Agricultural Experiment Station.

(c) F. W. Blaisdell. (e) To obtain data for design purposes.

(f) To provide data for the design of transitions where the velocity is greater than the critical.

(g) Study will cover transitions for use in the approach to the St. Anthony Falls stilling basin. Surface contours are determined for different Froude numbers, shapes of entering stream, sidewall flares, bed slopes, etc.

(h) Study under way. Progress report on tests to date is being prepared.

(i) Studies to date give surface configuration for one floor slope and one in $3\sqrt{F}$ sidewall divergence for Froude numbers from 1 to 16.

(115) CORRUGATED PIPE DROP INLET CULVERTS.

(b) Minnesota Department of Conservation, Division of Water Resources and Engineering; Division of Drainage and Water Control, Soil Conservation Service, U. S. Dept. of Agriculture; Northwestern Division, Armco Drainage and Metal Projects, Inc.; Minnesota Agricultural Experiment Station.

(c) A. W. Sturman. (e) To obtain design information.

(d) Walter S. Olson, Director, Division of Water Resources and Engineering, Minnesota Department of Conservation, St. Paul, Minn.

(f) To obtain information on the hydraulics of the structure, to obtain head-discharge curves for the inlet, to develop an energy dissipator, and to study flow conditions in the downstream channel.

(g) This structure is to be used as a drop structure for drainage ditches and highway culverts. Tests are being conducted on corrugated Lucite pipe and movable bed channels.

(h) Experiments are progressing slowly due to the inability of personnel to devote full time to the study.

THE UNIVERSITY OF MISSOURI, School of Mines and Metallurgy, Rolla, Mo.

Inquiries concerning Projects No. 116 and 117 should be addressed to Prof. Joe B. Butler, School of Mines and Metallurgy, University of Missouri, Rolla, Mo.

(116) FLOW THROUGH SMALL LOW HEAD SYPHONS.

(b) Laboratory project. (c) J. B. Butler, E. R. Broadbent, E. A. Weinel.

(e) For general information.

(f) To note discharge, friction loss, and peak suctions in syphons made of rubber hose, smooth bent iron, lead and brass pipes, welded joint pipes, pipes connected with common screw-end pipe elbows and in deviated flow around common screw-end Tees under low heads varying from 4 to 0 feet. Later in project, flaring outlets and changing of pipe sizes throughout the length of the syphons will be introduced.

(g) The primary purpose will be for student demonstrations in hydraulics to demonstrate friction and suction effects. If a more thorough search of hydraulic literature shows a substantial part of this project to involve new research, the results so obtained will be prepared for publication.

(h) Largely qualitative and observational with garden hose and screw-end jointed pipe used in student demonstration with outlet heads varying from 3 to 0 feet.

(i) Present references are short statements from hydraulics text. Currently searches will be made into the full field of published literature so that more of the search can go into fields not covered by experiments.

(117) STUDY OF SUCTION IN TUBES AND SMALL HYDRAULIC APPLIANCES ESPECIALLY AS LIMITED OR AFFECTED BY ADHESION AND COHESION OF AIR AND WATER.

(b) Laboratory project. (c) J. B. Butler, E. W. Carlton, V. A. C. Gevecker.

(e) For general information.

(f) To note actual suction values where the application of Bernoullis theorum indicates specific values, and to crowd each device to where the tendency to flow full through action of adhesion and cohesion of water is cancelled against limiting suction values.

(g) The primary purpose will be for student demonstration in large hydraulic classes. As an extension of the search of hydraulic literature shows where a substantial part of this project as expanded can involve new research, the results so obtained will be prepared for publication.

(h) Largely qualitative and observational to start with, as showing students the limits where suction devices break down tendency for full flow at exit.

(i) Present references are short statements from hydraulic texts. Currently searches will be made into the full field of published literature so that more of the search can go into fields not covered by experiments.

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY, Newport News, Va.

Inquiries concerning Projects No. 118 to 124, inclusive, should be addressed to Mr. C. H. Hancock, Hydraulic Laboratory and Ship Model Testing Basin, Newport News Shipbuilding and Dry Dock Company, Newport News, Va.

(118) CONDENSER SCOOP DRAG TESTS.

(b) Laboratory project. (c) W. F. Taylor. (e) Experimental.

(f) To obtain the additional drag resistance on a ship due to the condenser scoop appendages.

(g) Scoops to be installed in the bottom of a float in the open test section of a circulating water channel. A suitable boundary layer to be created by roughening the surface. Measurements of the induced flow in the scoop and the increased drag on the float to be obtained.

(h) Awaiting completion of circulating water channel apparatus.

(119) FLUID FLOW BY BENTONITE METHOD.

(b) Laboratory project. (c) J. F. Snyder, W. F. Taylor.

(e) Experimental data.

(f) To investigate and calibrate the Bentonite method of visualizing fluid flow.

(g) Observe, through a polariscope, the streaming double refraction, of a Bentonite suspension. Study the grades of Bentonite, methods of making and refining the suspension, and work up polariscope, model-making and testing procedure. Calibrate the flow so that the method may be used in our fluid flow problems.

(h) Unfinished.

(i) Details of method may be found in "Visual studies of fluid flow patterns resulting from streaming double refraction" by Davis R. Dewey, II, Doctor of Science thesis, Dept. of Chemical Engineering, Massachusetts Institute of Technology, 1941.

(120) RUDDER TESTS.

(b) Hull Technical Division, Newport News Shipbuilding and Dry Dock Company.

(c) W. F. Taylor, B. R. Lee. (e) Experimental, design data.

(f) To obtain moment and lift on ships' rudders for design data.

(g) Test ships' rudders in a circulating water channel.

(h) Unfinished; waiting completion of circulating water channel.

(121) ANGULAR MOTION OF SHIPS IN WAVES.

(b) Hull Technical Division, Newport News Shipbuilding and Dry Dock Company.

(c) W. F. Taylor. (e) Experimental investigation of theoretical question.

(f) To determine if a ship in a quartering sea rolls and pitches at its so-called natural periods, or if it assumes some angular motion, not true rolling or pitching, but a combination of the two, having some period between the so-called natural periods of rolling or pitching.

(g) A model was ballasted to exaggerate the difference between the natural period of rolling and pitching and then moored in the 56-foot model basin through gimbals, allowing rolling and pitching, and a parallel motion linkage, allowing heaving, but not restraining yaw and lateral oscillation. The model at various headings was subjected to waves of various lengths. Data from a chronograph were recorded as period of waves vs period of rolling, pitching, or heaving for each heading. Because the preliminary apparatus lacked stiffness, and restrained longitudinal and transverse oscillation and recorded only period and not amplitude, it was decided to redesign the apparatus and repeat the test.

(h) The redesigned apparatus has been completed and tested, but the results have not been analyzed.

(122) CAVITATION TURBINE TESTS.

(b) Hydraulic Division, Newport News Shipbuilding and Dry Dock Company.

(c) B. R. Lee, K. S. Black, W. C. Madison.

(e) Experimental for design data on hydraulic turbines.

(f) To determine critical sigma of various designs.

(g) Scale model turbines are tested at constant speeds and varying suction heads to determine sigma at which the efficiency and head curves drop. Latest test was made in connection with Russian turbines for Dnieprostroi Dam.

(h) To be continued as required.

(i) New apparatus being installed which will enable higher suction heads and consequently lower sigmas.

(123) REGULAR TURBINE TESTS.

(b) Hydraulic Division, Newport News Shipbuilding and Dry Dock Company.

(c) B. R. Lee, K. S. Black, W. C. Madison.

(e) Experimental for design data on hydraulic turbines.

(f) To determine power and efficiency curves for various unit speeds.

(g) Scale model turbines are tested at various unit speeds and calculations made to determine efficiency and unit horsepower. Recent tests included work on turbine models for Grand Coulee Dam in Washington and Dnieprostroi Dam in Russia.

(h) To be continued as required.

(124) METER CALIBRATION TEST.

(b) Hull Engineers, Newport News Shipbuilding and Dry Dock Company.

(c) B. R. Lee, K. S. Black, W. C. Madison. (e) Production.

(f) Calibrate gasoline or water meters used for testing or about to go aboard ship.

(g) Meters tested at various heads and quantities by the usual weighing tank. Time recorded electrically by chronograph.

(h) As required.

UNIVERSITY OF NORTH CAROLINA, North Carolina State College of Agriculture and Engineering, State College Station, Raleigh, N. C.

(125) DYNAMIC SIMILARITY OF SMALL HYDRAULIC MODELS.

(b) Laboratory project. (c) N. W. Conner.

(d) Prof. N. W. Conner, Department of Engineering Research, University of North Carolina, Raleigh, N. C.

(e) Theoretical research.

(f) To make a theoretical study of dynamic similarity of small hydraulic models and at large-scale ratios.

(g) The results of the experiments will be coordinated with existing data to form an integrated series giving a complete picture of present knowledge.

(h) One paper is in the process of being written.

NORTHWESTERN UNIVERSITY, The Technological Institute, Evanston, Ill.

(126) RESISTANCE OF BARGE FORMS IN SHALLOW WATER AND RESTRICTED CHANNELS.

(b) Laboratory project. (c) W. S. Hamilton.

(d) W. S. Hamilton, Civil Engineering Department, Northwestern Technological Institute, Evanston, Ill.

(e) Experimental, for fundamental information.

(f) To determine the resistance coefficients of simple barge forms in terms of the shape and dimensions of the forms relative to the depth and width of the water in which they are towed.

(g) Barge models are towed at constant speed in a tank in which the depth and width are variable. The tow line and pulleys are driven by an electric motor; the velocity is measured with a spark chronograph, and the towing force with a recording dynamometer carried by the model.

(h) Preliminary tests on the apparatus have been made and a new dynamometer is under construction. No results are available.

(i) For a description of the towing tank see "A simple apparatus for measuring the speed and resistance of hull models" by Wallis S. Hamilton, Marine Engineering and Shipping Review: 163-166. September 1945.

(127) RELIEF FROM WATER HAMMER BY MECHANICAL-PNEUMATIC SURGE SUPPRESSORS.

(b) Laboratory project. (c) M. B. Gamet, L. H. Kessler.

(d) Prof. M. B. Gamet, Acting Chairman, Civil Engineering Department, Northwestern Technological Institute, Evanston, Ill.

(e) Experimental, for design purposes.

(f) To increase the shock-absorbing capacity of mechanical-pneumatic water hammer arresters by placing nitrogen under pressure in the compression chamber, at a unit pressure equal in magnitude to flow pressures encountered in practice. The effective shock-absorbing capacity is increased with a corresponding reduction in overall size of the surge suppressor rather than having the compression chamber filled with a gas at atmospheric pressure.

(g) Performance is analyzed by pressure-time diagrams on water pipe lines upstream from the quick closing valve and surge suppressor. Fatigue tests of compression chamber unit are also conducted.

(h) One suppressor is under test with pressures of nitrogen in compression chamber varying from 5 to 90 psi. A large suppressor with 300 psi in compression chamber is under construction. Two-inch pipe lines supplied by standpipe and centrifugal pump are used at present.

(i) "Relief from water hammer." Jour. A.W.W.A., Vol. 30, No. 1, January 1938.

"Performance of fluid impact absorbers for water supply piping in buildings." Merrill B. Gamet. M.S. thesis, University of Wisconsin Library, 1937.

THE OHIO STATE UNIVERSITY, Department of Mechanical Engineering, Columbus 10, Ohio.

(128) A STUDY OF PULSATING FLOW THROUGH INFERENTIAL HEAD METERS.

(b) A.S.M.E. Special Research Committee on Fluid Meters. (c) E. J. Lindahl.

(d) S. R. Beitler, Professor of Hydraulic Engineering, The Ohio State University, Columbus 10, Ohio.

(e) Experimental investigation of error in meter-reading caused by pulsating flow through meters.

(f) To determine numerical values of errors and methods of eliminating them.

(g) Orifice meters have been set up to measure gas and air, with arrangements to accurately measure the quantity, with the meter subject to pulsating flows, and with steady flow. Apparatus has been devised to measure pulsation amplitude and to determine whether a meter is inaccurate due to pulsation. Different methods of eliminating the effects of pulsations have been tried.

(h) A new laboratory set-up is being constructed to study tuned types of eliminators.

(i) The following papers have been published covering this work:

"Developments in the measuring of pulsating flows with inferential-head meters." S. R. Beitler, E. J. Lindahl, and H. B. McNichols. Trans. A.S.M.E., Vol. 65, No. 4: 350-352. May 1943.

"Pulsation and its effect on flow meters." E. J. Lindahl. Trans. A.S.M.E., Vol. 68, No. 8: 883-894. November 1946.

THE PENNSYLVANIA STATE COLLEGE, School of Engineering, State College, Pa.

(129) WATER TUNNEL MODEL STUDIES.

(b) Ordnance Research Laboratory at The Pennsylvania State College.

(c) J. M. Robertson, D. Ross, A. M. Feiler, W. M. Wachter.

(d) Prof. J. M. Robertson, Hydraulics Laboratory, School of Engineering, The Pennsylvania State College, State College, Pa.

(e) An experimental and theoretical study for design purposes.

(f) To develop methods for predicting flow conditions in water tunnel components.

(g) Water tunnel components, with diameters one-eighth the proposed prototype dimensions, are being studied in a model tunnel which does not include a model pump. Flow is taken from and returned to a sump in a single pass system and is measured over a standard rectangular weir. The model test section diameter is 6 inches and velocities up to 50 fps are possible. As the sections are interchangeable, various lengths of components, shapes of nozzles, and angles of diffusion and various sized turns may be tested. The components are studied as they are inter-related; thus in the diffuser, to simulate prototype entrance conditions over a large range of Reynolds numbers, the length of the straight (or test) section preceding the diffuser is varied over wide limits. Experimental results are integrated with theoretical methods, in an attempt to develop means for predicting prototype flow conditions for use in design.

(h) Tests are in progress. Satisfactory methods appear to have been developed for the nozzle analysis. Test results appear to correlate well with modern theory on flow in the straight (test) section when proper allowance is made for nozzle effects. Diffuser flow analysis has reached the stage where a parametric form of presentation is available for tunnel design.

(130) WATER-TUNNEL VANED-TURNS STUDIES.

(b) Ordnance Research Laboratory at The Pennsylvania State College.

(c) J. M. Robertson, A. J. Turchetti, D. Ross.

(d) Prof. J. M. Robertson, Hydraulics Laboratory, School of Engineering, The Pennsylvania State College, State College, Pa.

(e) Experimental study for design purposes; also M.S. thesis.

(f) To determine the best contour and proportions of the turning vanes to be used in the four turns of the water tunnel.

(g) Studies will be concentrated on the pressures on and flow conditions after a vane design based on aerodynamic practice. This type vane will be tested in two sized turns (10-inch and 12-inch diameter) with several different gap-chord ratios. Tests will be made in model tunnel (see Project No. 129) and will attempt to study the cavitation propensities of the turn under conditions simulating prototype operation.

(h) Vanes of 1.5-inch chord are being fabricated.

(131) SHAVER CREEK HYDROLOGIC STUDY.

(b) Cooperative project with U. S. Weather Bureau and U. S. Forest Service.

(c) J. R. Villemonte, J. M. Robertson, W. M. Wachter.

(d) Prof. J. M. Robertson, Hydraulics Laboratory, School of Engineering, The Pennsylvania State College, State College, Pa.

(e) Long term study of hydrologic action of a watershed.

(f) To obtain data on rainfall, runoff, and evaporation for a small mountain watershed.

(g) The watershed area is about 3.8 square miles. Runoff is measured by a calibrated stream control (see Project No. 132), rainfall is measured with three recording rain gages, and evaporation from a standard pan.

(h) Measurements are under way, initial reduction of data is continuing.

(i) This project was started in 1941 by F. T. Mavis (now at Carnegie Institute of Technology) and J. R. Villemonte (at present on leave).

(132) A NEW TYPE OF STREAM CONTROL.

(b) Laboratory project. (c) J. R. Villemonte.

(d) Prof. J. M. Robertson, Hydraulics Laboratory, School of Engineering, The Pennsylvania State College, State College, Pa.

(e) Experimental project.

(f) To develop a new type stream control for stream gaging work.

(g) Model and prototype studies (see description of weir in abstract of paper by Villemonte).

(h) At present inactive due to absence of Prof. Villemonte.

(i) Recent work as an undergraduate thesis was done on a version of this control for smaller flows.

"New type gaging station for small streams." J. R. Villemonte. Engineering News Record 131: 748-750. November 18, 1943.

Based on model and prototype studies, a new type of gaging station for small streams has been developed. The measuring weir is created by installing two triangular-shaped sills on the floor of a culvert, a small space between the sills creating a throat. For large flows, the control shifts from the sills to the inlet wingwalls of the culvert. A silling pipe supporting the level recorder is installed upstream. Rating curves and effects of submergence are provided.

(133) WEIR STUDIES.

(b) Laboratory project. (c) J. R. Villemonte.

(d) Prof. J. M. Robertson, Hydraulics Laboratory, School of Engineering, The Pennsylvania State College, State College, Pa.

(e) Experimental project.

(f) Study of proportional and other weirs and the effect of submergence on their discharge characteristics.

(h) Inactive due to absence of Prof. Villemonte.

(i) "Proportional Weir Work." Engineering News Record 132: 461. April 6, 1944.

A history of proportional weir work, with a discussion of recent developments.

UNIVERSITY OF PENNSYLVANIA, Civil Engineering Department, Philadelphia 4, Pa.

(134) EXPERIMENTS ON VENTURI METERS OF HERSCHEL TYPE.

(b) Conducted for meter manufacturers and as a laboratory project.

(c) W. S. Pardoe.

(d) Prof. W. S. Pardoe, Civil Engineering Department, University of Pennsylvania, Philadelphia 4, Pa.

(e) An experimental investigation.

(f) To determine the effect on the coefficient of the size and number of throat piezometer holes, and the condition and shape of the throat piezometer holes.

(g) Experiments conducted on 10-inch by 5-inch Simplex Valve and Meter Company and 8-inch by 4-inch Builders Iron Foundry Venturi meters with removable bronze throats. Size of holes 1/16-inch to 1-inch, number of holes 1 to 6. Condition of holes, burrs due to drilling, edges square and flush, countersunk and rounded edges.

(h) About half completed.

(i) This is not a duplication of Prof. Allen's work, as the velocity traverse is flat at the throat of a Venturi meter.

PENNSYLVANIA WATER & POWER COMPANY, Lexington Building, Baltimore 3, Md.

(135) WATER MEASUREMENTS WITH ARTIFICIAL RADIO-ACTIVE MATERIALS.

(b) Pennsylvania Water & Power Company.

(c) J. E. Allen, S. K. Waldorf, Dean B. Cowie (consultant).

(d) J. E. Allen, Chief of Tests, Pennsylvania Water & Power Company, 1611 Lexington Building, Baltimore 3, Md.

(e) Experimental project. (f) Testing large hydraulic turbines.

(g) Water measurements by tracer methods using artificial radio-active isotopes will be investigated. Methods and apparatus will first be developed for precise measurements of weak radio-active solutions. For turbine testing the accuracy of measurement must be a small fraction of one precent. Actual measurements of water will then be made, first volumetrically in a large weighing tank, and second with flowing water in the Holtwood Hydraulic Laboratory. Both Geiger-Muller counters and improved electrometers will be studied to determine the method most suitable.

(h) Development work on apparatus for measurement of weak solutions is now in progress in the laboratory.

(136) (137) (138)

The three following studies are closely interrelated in an attempt to derive reliable basic material for further studies on the hydrology of a large river basin. This is done not only for the purpose of current forecasting, but to explore the underlying principles concerning the fluctuations of rainfall and runoff. After evaluation of ground water, it has been found possible to develop excellent correlations between the monthly rainfall and the amount of water which will eventually, even if not immediately, appear as runoff. (See graphs p. 636, Journal A.W.W.A., Vol. 37, No. 7, July 1945). These permit constructing a sufficiently close approximation of the mass curve of runoff to extend with considerable confidence the actual mass curve some twenty-five years prior to the beginning of any stream gauging on the Susquehanna River.

(136) REFINEMENT OF FLOW RECORD FOR THE SUSQUEHANNA RIVER.

(b) Research project. (c) Office of Special Studies.

(d) Carroll F. Merriam, Pennsylvania Water & Power Company, P. O. Box 2076, Baltimore 3, Md.

(e) Statistical analysis and reconciliation of systematic errors in four independent continuous measurements of stream flow.

(f) To maintain the highest possible degree of reliability in a long river flow record for eventual use in hydrologic research.

(g) Reduction of original data to comparable form by elimination of known systematic errors, exacting graphic analysis to accentuate accidental errors and final averaging of the four components.

(h) There is now available continuous record on uniform basis from 1931 and work is currently carried on. The fact that twelve month totals for each component record taken independently regularly fall within range of 0.7 percent indicates that consistency in determination of annual runoff to order of 0.3 percent is obtained.

(i) On completion of each year's work the results are reported to the U. S. Geological Survey.

(137) EVALUATION OF GROUND WATER IN SUSQUEHANNA RIVER.

(b) Research project. (c) Office of Special Studies.

(d) J. V. Stumpf, Pennsylvania Water & Power Company, P. O. Box 2076, Baltimore 3, Md.

(e) Analysis of data collected by the U. S. Geological Survey on ground water levels in Pennsylvania and New York and reduction of data to comparable basis to make possible derivation of index figure representing the average in spite of wide variations in the specific characteristics of individual wells. Reduction of this average to quantitative determination of water stored and eventually to appear as runoff. Determination of resulting ground water hydrograph.

(f) Prediction of assured flow, that is, flow which could be guaranteed even without further rainfall.

(h) Determination of weekly average now reduced to routine and forecasts of assured flow based upon ground water hydrograph plus surface water flow made currently for two weeks in advance. Constant checks of unusual nature made to insure reliability of data.

(i) Evaluation of ground water has been found to be key to further analysis of operation of hydrologic cycle in the Susquehanna.

"Analysis of natural fluctuations in ground-water elevation." Carroll F. Merriam. Trans. American Geophysical Union, Pt. II, 1942: 598-603.

American Water Works Assn., Vol. 37, No. 7: 632. July 1945.

(138) DISTRIBUTION OF RAINFALL AND RUNOFF IN THE SUSQUEHANNA VALLEY WITH RESPECT TO AREA AND TIME.

(b) Research project. (c) Office of Special Studies.

(d) Carroll F. Merriam, Pennsylvania Water & Power Company, P. O. Box 2076, Baltimore 3, Md.

(e) Application of statistical methods effective in forcing the betrayal of observational errors in past records.

(f) To prepare data of sufficient refinement to be used as basis for hydrologic studies with minimum danger of misleading results. These data are intended to be the most reliable for cyclic analysis, tests for secular trends, correlation with other meteorologic data, etc.

(g) Stream gauge records and particularly individual rain gauge records have been shown to be subject to observational errors which have in some cases led to seriously misleading conclusions.

(h) Attempt is made partly by identification of these errors and partly through weight of number or records averaged together to build up records which will be as free as possible from these disturbing defects, and so permit more reliable deductions to be drawn regarding nature of fluctuations in water supply and correlations with other contemporary observations.

(i) Consistency of interrelation between runoff and rainfall as determined independently of each other indicates that a considerable degree of success has been obtained.

PRINCETON UNIVERSITY, School of Engineering, Princeton, New Jersey.

(139) TOWING TANK RESEARCH.

(b) David Taylor Model Basin, Navy Dept., and laboratory project.

(c) J. W. Harrison, A. D. Hay, C. P. Kittredge.

(d) Prof. A. D. Hay, Towing Tank Director, School of Engineering, Princeton University, Princeton, N. J.

(e) Theoretical and experimental research.

(f) To explore some fundamental research in hydraulics hitherto untouched by the larger model basins.

(g) Present work is confined to towing simple geometric forms through the surface of water for resistance and wave measurements, and analyzing the relations between results.

(h) Two reports have been completed and two others are about to be published.

S. MORGAN SMITH COMPANY, York, Pa.

Inquiries concerning Projects No. 140 to 143, incl., should be addressed to Mr. George A. Jessop, Chief Engineer, S. Morgan Smith Company, York, Pa.

(140) EFFICIENCY, DISCHARGE, AND CAVITATION TESTS ON ADJUSTABLE BLADE AXIAL FLOW PUMPS.

(b) S. Morgan Smith Company.

(c) R. Sahle, J. Thorell, and laboratory personnel. (e) Experimental research.

(f) To determine the discharge, efficiency, and cavitation limits of various blade designs.

(g) Complete pump model was made and installed in our closed system pump stand. Pitot tube traverses were made above and below the impeller in order to determine the velocity distribution and angle of flow of water in the suction tube and as the water entered the stationary guide vanes in the discharge tube. Cavitation tests were conducted and the value of sigma determined by the usual method. New impeller and guide vanes were designed from this data and the tests repeated.

(h) Tests are now in progress.

(141) ADJUSTABLE BLADE SEWAGE PUMP, DISCHARGE, EFFICIENCY AND CAVITATION TESTS.

(b) S. Morgan Smith Company.

(c) R. Sahle, J. Thorell, and laboratory personnel. (e) Experimental research.

(f) To determine the discharge, efficiency, and cavitation limits on a special design spiral casing using an adjustable blade impeller.

(g) A complete pump model was made and installed in a closed system pump stand. The pump has no guide vanes in the spiral discharge casing or suction bell intake. This type of pump is specially designed for sewage pumping. Pitot tube traverses were made above and below the impeller. Alterations in the spiral casing were made and tested.

(h) Tests are now in progress.

(142) FRANCIS TURBINE, EFFICIENCY AND POWER TESTS, ALTERATIONS MADE ON RUNNER DESIGN.

(b) S. Morgan Smith Company.

(c) R. Sahle and laboratory personnel. (e) Experimental research.

(f) To obtain additional power and still maintain high efficiency by making alterations to the runner designs.

(g) Investigation was carried out in an open flume and on a vertical draft tube. Pitot tube traverses were made at various locations in the gate section of the wheel case and also in the draft tube below the runner. The direction of flow and the velocity was measured at each location. These tests were run at several gate openings. New and improved designs will be made from these data and further testing will be done.

(h) Tests are now in progress.

(143) STUDY OF PRESSURE CONDITIONS IN A SPECIAL DESIGN RIGHT-ANGLE ELBOW WITH GUIDE VANES AND SPECIAL DESIGN ROTO-VALVE INSTALLED IN A HIGH VELOCITY PIPE LINE.

(b) Board of Water Supply, City of New York, Kensico Hill View Station.

(c) John Haupt, New York Board of Water Supply; R. Sahle and laboratory personnel, S. Morgan Smith Company.

(d) Mr. F. G. Switzer, New York Board of Water Supply, New York, N. Y.; or Mr. George A. Jessop, Chief Engineer, S. Morgan Smith Company, York, Pa.

(e) Experimental research.

(f) The object of these tests is to determine, primarily, the low pressure area where cavitation may occur and means of reduction or elimination. To determine the low pressure area by means of observation through Lucite windows, piezometer connections and by Pitot tube measurements.

(g) A complete model of the pipe line which included a bell mouth intake, right-angle elbow with special design guide vanes, Roto-valve with a special design plug, and a discharge nozzle was installed in the laboratory. A section of the pipe line is made of Lucite in order to observe the flow condition in the elbow at the guide vane section and in the entrance and discharge end of the valve plug. Three designs of special guide vanes in the elbow were tested. Pressure distribution in the section between two of the guide vanes in the elbow was determined by means of piezometers. Pitot tube traverses were made to determine the velocity distribution and angle of flow at the discharge end of the guide vane section. Pressure readings were taken at various locations in the Roto-valve plug and body. Pressure readings were also taken when the plug was located at several angles of valve opening. A number of changes were made to the valve plug to obtain the best pressure

condition. The model was tested under field head conditions.

(h) The tests are now in progress.

SOUTHERN METHODIST UNIVERSITY, School of Engineering, Dallas, Texas.

(144) AN INVESTIGATION OF THE USE OF THE STANDARD PIPE TEE AS A FLOW MEASURING DEVICE.

(b) Laboratory project. (c) Senior civil engineering students.

(d) Prof. I. W. Santry, Jr., School of Engineering, Southern Methodist University, Dallas, Tex.

(e) General experimental research and student thesis.

(f) The work is to determine whether or not such a simple device as a pipe tee could be used for measuring flow and what reliance could be placed on the results of such a device.

(g) The investigations of several different students will be coordinated in a general paper on this subject to treat with the methods followed and results obtained. Work is planned to cover the effects of the different types of tees, the spacing and location of manometer tubes and Pitot tubes, and the variations caused by age or condition of the tees.

(h) Has not been worked on in several years because of the war, but in the next year the project will be resumed.

(i) Three undergraduate student theses have been written for partial fulfillment of the requirements for a B.S. degree in civil engineering:

"The investigation of standard pipe tee as a flow measuring device." A. P. Hundley, Jr.

"Investigation of the use of the standard pipe tee as a flow measuring device." R. L. Tate and James K. Walker.

"An investigation of the use of the standard pipe tee as a flow measuring device." R. L. Goodson, Jr., and W. S. Montgomery.

(145) DISCHARGE RELATIONSHIPS OF CIRCULAR WEIRS.

(b) Laboratory project. (c) Senior civil engineering students.

(d) Prof. I. W. Santry, Jr., School of Engineering, Southern Methodist University, Dallas, Tex.

(e) General experimental research and student thesis.

(f) The research is to determine the discharge relationships for circular weirs of both the sharp-edged type and the broad-crested type, and the problems of design of such structures when used as intake structures.

(g) The investigations of different students will be consolidated into a general paper on this subject that will cover the problems of design of such structures under varying conditions of flow. Only the preliminary work has been done up to the present, but as more students become available for thesis work, the problem will be expanded into definite model studies and their actions. In determining the discharge relationships of these weirs, the head and discharge were determined during the process of increasing the head and decreasing the head, showing different characteristics with the same head. After sifting the data, empirical equations have been determined for the discharge. In the problem to date, only certain sizes of weirs have been considered, but since the actions of all sizes have proved to be the same, the advance work can now be considered.

(h) The project has not been worked on for several years, as the equipment was removed during the war. With the advance work which should start in the next year, new equipment will be built.

(i) Three undergraduate theses have been written on this subject to establish the necessary preliminary work:

"Discharge relation of circular weirs." R. F. Millar.

"Discharge relation of circular weirs." E. E. White and J. E. Headington.

"Discharge relation of circular weirs." J. D. Mahoney, Jr.

STEVENS INSTITUTE OF TECHNOLOGY, Experimental Towing Tank, Hoboken, N. J.

For a resume of the activities of this organization, refer to Laboratory Notes, page 150.

UTAH STATE AGRICULTURAL COLLEGE, Irrigation Research Laboratory, Logan, Utah.

(146) RESEARCH AND DEVELOPMENT OF AN ELECTRONIC METHOD OF MEASURING HYDROSTATIC PRESSURE.

(b) Utah State Agricultural College, School of Engineering, and the U. S. Geological Survey, Water Resources Branch.

(c) J. E. Christiansen, Dean of School of Engineering; W. V. Iorns, Project Engineer U. S. Geological Survey; V. E. Hansen.

(d) Vaughn E. Hansen, Utah State Agricultural College, Box 57, Logan, Utah.

(e) Experimental research for student thesis.

(f) To develop a practical electronic pick-up unit for measuring hydrostatic pressure that would be suitable for stream gaging.

(g) The scope of this study is to develop or adapt existing electronic equipment to the measurement of hydrostatic pressures, as applied to stream gaging. A survey is being made of commercial companies to find if any existing equipment can be readily adapted. The unit selected or developed must be rugged, of low cost, and dependable. The unit must measure hydrostatic pressures equivalent to 10 feet of head, with an accuracy of 0.01 foot. In the design contemplated, the fluctuating water level will actuate an element of the electrical circuit located on the stream bed. The impulse will be transmitted to a meter or recorder located on the bank or at some more convenient point. The field of irrigation and drainage is badly in need of applied electronics, to improve its measuring equipment. This study is an attempt to supply this deficiency.

(h) The study is still in the investigational stage. The laboratory testing equipment is completed, but the control element has not yet been constructed.

(151) LINING OF IRRIGATION CANALS AND DITCHES.

Cooperative project, Utah State Agricultural College and Soil Conservation Service, listed under above number, Soil Conservation Service, Irrigation Research Laboratory, Logan, Utah.

UNIVERSITY OF WISCONSIN, Hydraulic Laboratory, Madison, Wis.

(147) RAINFALL-RUNOFF RELATION, BIG EAU PLEINE RIVER.

(b) Laboratory project. (c) C. C. Warnick.

(d) Dr. Arno T. Lenz, Hydraulic Laboratory, University of Wisconsin, Madison, Wis.

(e) Thesis study for M.S. degree in civil engineering.

(f) To determine the rainfall-runoff relation for the Big Eau Pleine River above Stratford, Wis.

(g) Fifteen storms were analyzed and a rational approach sought to express the rainfall-runoff relation. It was found the base stream-flow at the time of beginning of rainfall was an important factor. Base flow and flood flow recession curves assisted in producing a consistent relation when a second storm produced runoff before a prior storm had receded to base flow.

(h) Project in progress.

(i) A brief summary of progress to date is available in Wisconsin Valley Hydrologic Research Project Report No. 3.

(148) MODEL STUDY OF PROPOSED ENTRANCE STRUCTURES FOR GARY SLIP.

(b) Carnegie-Illinois Steel Corporation. (c) A. T. Lenz.

(d) Dr. Arno T. Lenz, Hydraulic Laboratory, University of Wisconsin, Madison, Wis.

(e) Engineering Experiment Station experimental project.

(f) To determine an economical method of reducing wave action in the slip used by ore boats at the Gary Steel Works.

(g) A 1:50 scale model of the entrance of the 246-foot wide slip has been constructed in a new 11-foot by 40-foot concrete flume. A structure using floating type miter gates of various designs has been built and tested with waves of varying amplitude and length. Breakwater modifications will next be tested with a smaller scale model.

(h) Gate tests nearly completed.

(149) EFFECT OF SUBMERGENCE ON DISCHARGE OF SHARP-CRESTED WEIRS.

(b) Laboratory project. (c) J. R. Villemonte.

(d) Prof. James G. Woodburn, Hydraulic Laboratory, University of Wisconsin, Madison, Wis.

(e) Experimental laboratory study as thesis in partial fulfillment of requirements for Ph.D. Degree.

(f) To substantiate experimentally a new formula based partly on mathematical theory and partly on results obtained by previous investigators.

(g) Tests will be run with free and submerged discharge over sharp-crested weirs of various shapes -- proportional, rectangular full-width and contracted, circular, parabolic, triangular, and cusp parabolic. Tests will be run at constant discharge with varying degrees of submergence. Special attention will be given to the effect of downstream flow conditions on discharge.

(h) A paper is being prepared summarizing previous studies on this subject on which information is available. Equipment is being prepared to begin laboratory tests.

U. S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, North Appalachian Experimental Watershed, Coshocton, Ohio.

(150) HYDROLOGIC EXPERIMENT STATIONS.

(b) U. S. Soil Conservation Service.

(c) L. L. Harrold, Project Supervisor; Leonard Schiff, Hydraulic Engineer; Walter Pomerene, Agricultural Engineer, F. R. Dreibelbis, Soil Scientist.

(d) M. L. Nichols, Chief of Research, Soil Conservation Service, Washington 25, D.C.

(e) Experimental, for design and general information in planning farms for soil and water conservation.

(f) On whole farm units and watersheds to study the hydrologic effect of physiography, tillage and ground surface conditions, vegetal covers, and soils and geology. Also to study the effect of conservation farming on runoff and erosion as well as the characteristics of flood runoff on agricultural watersheds. On smaller areas studies are made of all the rainfall disposal factors such as surface runoff, evapo-transpiration, moisture storage and moisture transmission through the soil, and percolation of water to the ground-water table.

(g) On 1,000 acres of Government operated land and 5,000 acres of privately owned land, observations of rates and amounts of precipitation and runoff are made. About 35 recording rain gages and runoff stations are operated. Runoff stations have drainage areas ranging from 1 to 5,000 acres. Lysimeters, 1/500 acre in area and 8 feet deep of undisturbed soil and bed rock, are

used to measure disposal of rainfall. Three of these soil blocks which are weighed automatically at 10-minute intervals furnish reliable data on evapo-transpiration as well as condensation of moisture from the atmosphere on to vegetation and into the soil. Periodic soil-moisture observations in the root zone along with a few continuous records of soil moisture furnish data for the study of moisture movement under different crops in its relation to the capacity of the soil to take up storm rainfall.

(h) About ten years of records are available on the larger watersheds and records for one complete crop rotation on the small watersheds. Thus, sufficient data are now available for a detail preliminary analysis. Such has been started.

(i) "Studies on soil moisture relationships at the North Appalachian Experimental Watershed." F. R. Dreibelbis and F. A. Post. Proc. Soil Science Society of America 5: 377-385. 1940.

"Some of the factors influencing the behavior of perched water tables at the North Appalachian Experimental Watershed near Coshocton, Ohio." W. D. Potter and Merle V. Baker. Trans. American Geophysical Union, Pt. I: 393-402. 1938.

"An inventory of soil water relationships on woodland, pasture, and cultivated soils." F. R. Dreibelbis and F. A. Post. Proc. Soil Science Society of America 6: 462-473. 1941.

"Some seasonal changes in the pore space and moisture relationships of woodland, pasture, and cultivated soils." F. R. Dreibelbis and F. A. Post. Proc. Soil Science Society of America 8: 102-108. 1944.

"Studies of raindrop erosion." W. D. Ellison. Agricultural Engineering 25: 131-136, 181-182. 1944.

"A survey and discussion of lysimeters and a bibliography of their construction and performance." Helmut Kohnke, F. R. Dreibelbis, and J. M. Davidson. U.S.D.A. Miscellaneous Publication 372, 1940.

"Some influences of frost penetration and microclimate on the water relationships of woodland, pasture, and cultivated soils." F. A. Post and F. R. Dreibelbis. Proc. Soil Science Society of America 7: 95-104. 1942.

"Results from experimental rain gages at Coshocton, Ohio." Herbert S. Riesbol. Trans. American Geophysical Union, Pt. I: 542-550. 1938.

"Dual parshall flumes measure wide range of flows." Herbert S. Riesbol. Civil Engineering 9: 17-19. 1939.

"Techniques for hydrologic research." Herbert S. Riesbol. Agricultural Engineering 21: 269-273. 1940.

"Some aspects of subsurface water in hydrologic research on agricultural watersheds." Herbert S. Riesbol. Proc. Hydrology Conference, State College, Pa.: 85-112. 1941.

"Watercycle lysimeters for watershed studies." Herbert S. Riesbol and G. L. Sherman. Agricultural Engineering 19: 123-128. 1938.

"Dynamics of water erosion on land surfaces." Leonard Schiff and Robert E. Yoder. Trans. American Geophysical Union, Pt. II: 287-298. 1941.

"Classes and patterns of rainfall with references to surface runoff." Leonard Schiff. Trans. American Geophysical Union, Section of Hydrology, Pt. II: 438-451. 1943.

"Hydrologic data of North Appalachian Experimental Watershed, Coshocton, Ohio, for 1939." U.S. Dept. of Agriculture, Hydrologic Bulletin No. 1 of Hydrologic Division, Soil Conservation Service. 1941.

"Hydrologic data of North Appalachian Experimental Watershed, Coshocton, Ohio, for 1940." Hydrologic Bulletin No. 4 of Hydrologic Division, Soil Conservation Service, 1942.

"An accounting of the daily accretion, depletion, and storage of soil water as determined by weighing monolith lysimeters." L. L. Harrold and F. R. Dreibelbis. Trans. American Geophysical Union, Vol. 26, Pt. II: 283-292. 1945.

"Pertinent findings from Ohio Soil Conservation Research." H. L. Borst, L. L. Harrold, and R. E. Yoder. O.A.E.S. Mimeograph No. 95. 1944.

"A summary of percolation and other hydrologic data." F. R. Dreibelbis and L. L. Harrold. Soil Science Society of America, Vol. 10: 451-457. 1946.

"Some plant nutrient losses in gravitational-water." F. R. Dreibelbis. Proc. Soil Science Society of America, Vol. II.

U. S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, Irrigation Research Laboratory, Logan, Utah.

(151) LINING OF IRRIGATION CANALS AND DITCHES.

(b) U. S. Dept. of Agriculture, Soil Conservation Service, and the Utah State Agricultural College, Agricultural Experiment Station.

(c) C. W. Lauritzen, O. W. Israelsen.

(d) C. W. Lauritzen, Soil Conservation Service, College Hill, Box 179, Logan, Utah.

(e) General experimental research.

(f) To determine the value of materials for lining irrigation canals and ditches as a means of conserving water and soil; to obtain information relative to specifications and management influencing the effectiveness and durability of linings in irrigation canals and ditches.

(g) Investigations will be limited for the most part to earth materials of various kinds and fabrics, and such new materials as may be developed. The laboratory is located on the Logan River at the mouth of Logan Canyon. The principle feature of the laboratory is four channels simulating canals. The channels are 9 feet wide and 160 feet long. Each channel is divided into eight sections, and each section is provided with independent under-drainage. The stream is continuous in each channel, making it necessary to operate the channels as a unit. In cross-section the channels consist of a concrete intercepting basin, on the bottom and in the center of which is a 2-inch perforated pipe. Resting on the concrete and over the pipe is an 8-inch mat of washed and graded gravel. This gravel mat serves as a support for the linings and as a porous medium for conveying the percolating water to the perforated pipe and thence to the manhole outlets where it can be collected and measured. The channels are level and the stream used is small, just sufficient to eliminate dead water. Obviously the erosion factor is outside the range of these facilities. This factor is not being neglected entirely, however, the susceptibility of various lining materials to erosion due to stream characteristics such as water velocity is being studied on a limited scale through the facility of a flume located in the hydraulic laboratory in the Engineering Building on the campus of the Utah State Agricultural College.

U. S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

For reports on projects conducted by the Soil Conservation Service at the St. Anthony Falls Hydraulic Laboratory, refer to Projects No. 111 to 115, incl., pages 37 and 38, listed under University of Minnesota.

U. S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, Stillwater Outdoor Hydraulic Laboratory, Stillwater, Okla.

(152) (931) THE HYDRAULICS OF CONSERVATION CHANNELS.

(b) Soil Conservation Service, U. S. Dept. of Agriculture. (c) W. O. Ree.

(d) Lewis A. Jones, Chief, Division of Drainage and Water Control, Soil Conservation Service, Washington 25, D. C.

(e) Experimental research at an outdoor hydraulic laboratory.

(f) To obtain data on the effects of linings, vegetal and non-vegetal, on the water-carrying capacity and other hydraulic characteristics of channels used in soil and water conservation operations.

(g) Measured flows up to 150 cfs are passed through outdoor test channels of various cross-sections up to 40 feet in width and slopes up to 10 percent, and measurements of the hydraulic elements are made to determine the effect of different linings on channel capacity. All work to date has been done on vegetal linings.

(h) Vegetations tested to date include Bermuda grass, weeping lovegrass, Sudan grass, yellow bluestem, Smooth brome, and mixtures of native Oklahoma grasses including little bluestem, rye grass, side oats grama, blue grama, and miscellaneous annuals.

(i) This work was formerly conducted at Spartanburg, S. C. A technical bulletin covering the South Carolina vegetal studies has been prepared and is now awaiting publication.

(153) (933) THE STABILITY OF CONSERVATION CHANNELS.

(b) Soil Conservation Service, U. S. Dept. of Agriculture. (c) W. O. Ree.

(d) Lewis A. Jones, Chief, Division of Drainage and Water Control, Soil Conservation Service, Washington 25, D. C.

(e) Experimental research at an outdoor hydraulic laboratory.

(f) To obtain data on the protective characteristics of various types of linings, vegetal and non-vegetal, for channels employed in soil and water conservation operations.

(g) The outdoor test channels used in the study of the Hydraulics of Conservation Channels are also used in this study. For each channel lining, rates of scour or other damage are determined for flows of different velocities. From these data, permissible velocities for the different covers are determined.

(h) The linings tested to date include those listed in the study of the Hydraulics of Conservation Channels. In addition, scour rates have been compared for soils of different texture with Bermuda grass as a lining.

(i) This work was formerly conducted at Spartanburg, S. C. A technical bulletin covering the South Carolina vegetal studies has been prepared and is now awaiting publication.

U. S. DEPT. OF COMMERCE, NATIONAL BUREAU OF STANDARDS, National Hydraulic Laboratory, Washington 25, D. C.

Inquiries concerning Projects No. 154 to 166, incl., should be addressed to Chief, National Hydraulic Laboratory, National Bureau of Standards, Washington 25, D. C.

(154) (563) AGING TESTS ON PIPES.

(b) U. S. Treasury Dept. (c) K. H. Beij. (e) Experimental, design.

(f) To determine the effects of long-continued service on the hydraulic friction of pipes.

(g) Specimens of 1-1/2-inch pipes of nine different materials have been installed in a cold-water service line, and specimens of 3/4-inch pipes of seven different materials in a hot-water service line at the National Bureau of Standards. The hydraulic friction in these specimens is compared with the friction in smooth copper pipes.

(h) Tests before aging started were made in 1936; observation tests were made in 1937, 1938, and 1940. The tests scheduled for 1942 were postponed and are now planned for 1947.

(155) (977) MATHEMATICAL THEORY OF FLOOD WAVES.

(b) U. S. Weather Bureau. (c) G. H. Keulegan.

(e) General theoretical research.

(f) To review and supplement American and foreign literature on the mathematical theory of waves which is applicable to the theory of flood waves.

(g) The results of the review will be coordinated and extended by new proofs and additional material to form an integrated series of papers giving a complete picture of present knowledge useful in the study of flood waves.

(h) The third paper is nearing completion.

(i) "Mathematical theory of irrotational translation waves." Garbis H. Keulegan and George W. Patterson. J. of Research, National Bureau of Standards. 24(RP1272): 47-101. January 1940.

"Effect of turbulence and channel slope on translation waves." Garbis H. Keulegan and George W. Patterson. J. of Research, National Bureau of Standards. 30(RP1544): 461-512. June 1943.

These publications may be obtained from the Superintendent of Documents, Washington 25, D. C., at 10 cents each (stamps not accepted).

(156) (1328) CONDENSING WATER CIRCULATION.

(b) Bureau of Ships, Navy Dept. (c) K. H. Beij. (e) Experimental, design.

(f) Model study of circulation of hot water discharged from a testing laboratory into a nearly closed ship basin, to determine (1) rise of temperature at intake of laboratory circulation system, (2) best location of outlet of system, and (3) other pertinent data disclosed by model tests.

(g) A model of the ship basin on a scale of 1:80 was constructed. Provision was made for simulating tides. Hot-water circulation systems were installed to represent two existing laboratories and the proposed laboratory, with provision for maintaining any desired discharges and temperatures. Temperatures were measured by thermocouples and thermometers. Travel of hot water was made visible using milk as a dye.

(h) All work was completed in August 1941.

(i) A publication covering phases of general interest is under consideration.

(157) FILLING SYSTEMS FOR DRY DOCKS.

(b) Bureau of Yards and Docks, Navy Dept. (c) K. H. Beij.

(e) Model studies of gravity filling systems for design.

(f) To check preliminary design and determine necessary modifications for (1) obtaining desired time of filling, (2) obtaining equal flow with low jets from all ports in floor, and (3) providing air relief to reduce cavitation during gate operation.

(g) The main model and its several modifications were built on a scale of 1:8.2. Numerous smaller models, on a scale of 1:24, were used to study sections of the filling systems.

(h) All work was completed in June 1942.

(i) A publication covering phases of general interest is under consideration.

(158) MODEL TESTS OF CONCRETE MOORING ANCHORS.

(b) Bureau of Yards and Docks, Navy Dept. (c) K. H. Beij.

(e) Experimental, design.

(f) Model tests to determine holding power, stability, and possible improvements in design.

(g) Models were dragged at fixed slow speeds in a submerged sand bed. Forces, speeds, and positions of the model were measured. One preliminary design was discarded because of instability. A second design was tested at scales of 1:12, 1:8, and 1:4. Numerous modifications of shape and dimensions were tested. It was found that the ratio of holding power to weight could be considerably increased by decreasing the vertical dimension without other change in shape. No other improvement resulted from the tests.

(h) All work was completed in February 1943.

(i) A publication covering phases of general interest is under consideration.

(159) MODEL LAWS FOR DENSITY CURRENTS.

(b) Office of the Chief of Engineers, War Dept. (c) G. H. Keulegan.

(e) A theoretical study to be supplemented by experimental research.

(f) To determine model laws.

(g) A theoretical analysis of available experimental data has been made to determine the nature and scope of experimental research required. Plans for experimental apparatus are being started.

(h) Date of completion is indefinite.

(160) EFFECT OF STORM WINDS ON LAKE LEVELS.

(b) Laboratory project. (c) G. H. Keulegan. (e) Theoretical.

(f) To determine surface frictional forces of wind on lake surfaces.

(g) Data on storms over Lake Erie are being analyzed.

(h) A publication during 1947 is contemplated.

(161) EXTINCTION OF SOLITARY WAVES.

(b) Laboratory project. (c) G. H. Keulegan. (e) Theoretical.

(f) To study dissipation of energy.

(g) The theoretical determination of dissipation is being compared with experimental results.

(h) A publication during 1947 is contemplated.

(162) FLOW PATTERNS AT PUMP INTAKES.

(b) Laboratory project. (c) G. H. Keulegan. (e) Theoretical.

(f) To determine flow patterns.

(g) Patterns are obtained theoretically by superposition of fields of circular vortices and sources and sinks.

(h) A publication during 1947 is contemplated.

(163) SHORT PIPES AND INTAKES.

(b) Laboratory project. (c) G. H. Keulegan. (e) Theoretical and experimental.

(f) To determine methods of computing energy losses.

(g) A theoretical analysis is being made of the boundary layer development in rough pipes. This will be followed by experimental research.

(h) Time of completion is indefinite.

(164) LIMITS OF STACK VENTING.

(b) Federal Public Housing Authority.

(c) J. L. French, E. E. Ferguson, R. S. Wyly, A. L. Lembeck.

(e) Experimental; to furnish information to code-making authorities.

(f) To investigate the effect on fixture-trap seals of reducing the diameter of the stack in stack-vented house sanitary drainage systems.

(g) Preliminary tests on the siphonage of fixture-trap seals in one and two-story house drainage systems have been completed for several sizes of stacks. Additional tests will be made to investigate the effect of reduction in the diameter of stack vents on the self-siphonage of fixture-trap seals.

(h) Temporarily inactive.

(165) WET VENTS IN PLUMBING SYSTEMS.

(b) Laboratory project.

(c) J. L. French, E. E. Ferguson, R. S. Wyly, A. L. Lembeck.

(e) Experimental. To furnish fundamental knowledge of hydraulic and pneumatic conditions in plumbing drainage systems.

(f) To determine the limits of application of wet venting in plumbing drainage systems.

(g) A typical wet-vented bathtub installation has been made, with the exception that various constant rates of discharge are introduced through the wet vent. The decrease in the bathtub trap seal is observed after each discharge of the tub. The rate of discharge through the wet vent; the rate of discharge of the tub; the length, slope, and diameter of the tub waste; the diameter of the wet vent; the length, diameter, and slope of the drain; and the form of stack fitting have been varied. Additional tests have been made with the discharge of standard lavatories and sinks into the wet vent.

(h) The experimental work has been practically completed, and a report will be written in the near future.

(166) WET VENTING AND SELF-SIPHONAGE TESTS OF PLUMBING SYSTEMS.

(b) National Housing Agency.

(c) J. L. French, E. E. Ferguson, J. A. Reed, R. S. Wyly, A. L. Lembeck, E. J. Norcome.

(e) Experimental; to furnish data for use in preparing a Uniform Plumbing Code.

(f) To investigate the effects of stack vacuum on the self-siphonage and wet venting results obtained in Project No. 165 and the completed project, "Self-siphonage of fixture traps", reported on page 116, and to obtain a photographic record of the hydraulic and pneumatic phenomena involved in self-siphonage and wet venting.

(g) One two-story and two one-story house sanitary drainage systems with complete kitchen and bathroom fixture installations and with the drainage system constructed entirely of transparent plastic pipe and fittings will be set up. Motion-picture records of the various flow and pressure phenomena will be made while the various fixtures are discharged.

(h) Procurement of equipment and materials is in progress. Tests will be started early in March.

U. S. Dept. of Commerce, Weather Bureau, Washington 25, D. C.

(167) DEVELOPMENT OF RIVER FORECASTING TECHNIQUES.

(b) U. S. Weather Bureau. (c) M. Bernard, R. K. Linsley, Jr., M. A. Kohler.

(d) Chief, U. S. Weather Bureau, Washington 25, D. C.

(e) Experimental project under the Bureau's program of procedure development.

(f) To develop procedures which will permit more accurate and more timely river forecasts, or will increase the operating efficiency of existing forecasting staffs.

(g) The project involves a combination of basic theoretical hydrology and statistics to make maximum use of available data. New instruments and procedures are reviewed to determine whether they may be used directly or by adaptation. Original ideas presented by the staff are reviewed, techniques developed and tested by actual trial in comparison with existing methods. Investigations are aimed at the following problems: (1) Forecasting the runoff from rainfall; (2) distributing runoff in time to predict the outflow from a basin; and (3) routing and combining flows from tributaries to predict flood-wave movement downstream.

(h) This is a continuing project and no phase can be reported as complete. Developments under (1) and (3) above are well advanced and techniques are now undergoing exhaustive tests to determine possibility of and need for further refinement. A pilot project under (2) above has been completed and plans for comparative testing of three original ideas are being formulated.

(168) SEASONAL WATER SUPPLY FORECASTING INVESTIGATIONS.

(b) U. S. Weather Bureau. (c) M. Bernard, R. K. Linsley, Jr., M. A. Kohler.

(d) Chief, U. S. Weather Bureau, Washington 25, D. C.

(e) Experimental project under the Bureau's program of procedure development.

(f) For development of forecasting procedures.

(g) The project is intended to (1) develop by statistical means a relation between precipitation, other meteorological factors and runoff for forecasting total seasonal runoff volume; and (2) develop the relations between meteorological data and time distribution of runoff for predicting increments of runoff for various time intervals. The project requires as a part of the solution the determination of the most effective statistical treatments, both graphical and analytical; the establishment of criteria for selection of representative meteorological stations and the development of methods of adjusting old records for differences in measurement technique and other effects which introduce a time trend into the record.

(h) A technique under item (g-1) is complete and under test to determine if further refinement is justified. Investigations under item (g-2) have just begun.

(i) Reference to preliminary work, "Forecasting seasonal runoff by statistical methods." Phillip Light and Max A. Kohler. Trans. American Geophysical Union, Pt. II. 1943.

U. S. DEPT. OF THE INTERIOR, GEOLOGICAL SURVEY, Washington 25, D. C.

(169) UNSATURATED FLOW OF WATER IN RELATION TO GROUND-WATER RECHARGE.

(b) U. S. Geological Survey, Water Resources Branch, Ground Water Division.

(c) W. O. Smith.

(d) Water Resources Branch, U. S. Geological Survey, Washington 25, D. C.

(e) Experimental and theoretical.

(f) Mechanics of nonsaturated flow of water in porous bodies.

(g) Preliminary experimental work has shown the factors to be considered. Apparatus has been designed for quantitative measurements.

(170) THE SPECIFIC YIELD OF ROCKS FOR WATER.

(b) U. S. Geological Survey, Water Resources Branch, Ground Water Division.

(c) W. O. Smith.

(d) Water Resources Branch, U. S. Geological Survey, Washington 25, D. C.

(e) Experimental and theoretical.

(f) Mechanics involved in the determination of specific yield of porous media.

(g) A theoretical analysis of the problem has given the factors determining the specific yield of rocks and a theoretical relation from which the specific yield may be found has been developed for uniform sands. It has been checked with field data.

(h) A paper is being prepared.

U. S. DEPT. OF THE INTERIOR, BUREAU OF RECLAMATION, Denver, Colo.

(171) SEDIMENTATION STUDIES.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(d) Chief Engineer, Bureau of Reclamation, Denver, Colo.

(e) Experimental study for general information.

(f) To check available formulae for sediment transportation and establish the relative effect of changes in flood discharge peaks and silt detention reservoirs on tributaries.

(g) A flume 2 feet wide and 130 feet long will be utilized. Initially a uniform fine sand will be used to establish and demonstrate various factors such as slope, water and solid discharge, and such conditions as equilibrium aggradation and degradation. The length of flume exceeds that used in past experiments to minimize end effects.

(h) Under construction.

(172) CAVITATION STUDIES.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(d) Chief Engineer, Bureau of Reclamation, Denver, Colo.

(e) Experimental etudy of a basic nature.

(f) To contribute fundamental information towarde a more complete understanding of cavitation.

(g) By use of a magneto-striction oscillator to set up cavitation for visual and high-speed photographic study. Attempts will be made to photograph the cavities in successive stagee of their development. Some experimental work connected with the resietance of some of the newer material to cavitation eroeion is aleo contemplated.

(h) Equipment nearing completion. Cooling problem not completely solved.

U. S. NAVY DEPT., DAVID TAYLOR MODEL BASIN, Washington 7, D. C.

Inquiries concerning Projects No. 173 to 178, incl., should be addressed to The Director, David Taylor Model Basin, Washington 7, D. C.

(173) STATISTICAL ANALYSIS OF TURBULENT FLOW IN TUBES.

(b) Navy Dept. (c) P. Eisenberg, J. V. Wehaueen, M. S. Maconsky.

(e) Experimental and theoretical inveetigations for general information.

(f) To investigate methods of describing turbulence and to obtain correlations with roughness and pressure change.

(g) The ultimate aim is to obtain correlations of turbulence with friction losses over a wide range of Reynolds numbers. Initial analysis is to be made from photographs of particles injected into the stream. Other methods, including attempts to measure preesure fluctuations, will also be undertaken.

(h) A preliminary set-up has been made, ueing underwater flow in plaetic tubing. The particle injection eystem has been inetalled and experimente on methods of photography have been completed. Actual tests will begin in January 1947. The design of a facility ie under way for obtaining flows up to 150 fps under heads up to 700 feet of water obtained by air pressure for tests at high Reynolds numbers. Theoretical work on methods of analysis is also being carried forward.

(174) CIRCULATING WATER CHANNEL.

(b) Laboratory project. (c) C. E. Bowers, C. A. Lee.

(e) The design, construction, and calibration of a circulating water channel to be used as a teet facility.

(f) The purpose of the facility is to provide a stream of flowing water with an essentially flat surface free from waves and having a uniform velocity throughout the test section.

(g) Three 1:22 scale models of the full scale circulating water channel have been designed, conetructed, and teeted. A full scale circulating water channel has been conetructed and partially calibrated. The full ecale water channel test section is 22 feet wide, 9 feet deep, and 60 feet long. The water channel structure ie a vertical closed loop with the test section situated in the upper horizontal leg. The facility is powered by two 1000-hp motors driving two vertically set adjustable blade propeller type pumps. The pump blades are adjusted for speed control which can be maintained to ±0.01 of a knot.

(h) Studies are being continued in the 1:22 ecale model on alterations to the full-ecale water channel. The full scale channel has been in operation ae a test facility for the past eighteen months. A manual for operation of the facility is in preparation.

(i) Reports and papers on all known attempts to construct a facility of similar nature have been collected and will be furnished to interested parties upon requeet.

"The circulating water channel of the David W. Taylor Model Basin." Capt. H. E. Saunders, U.S.N., and Lt. Comdr. C. W. Hubbard, U.S.N.R. Trans. Soc. of Naval Arch. and Marine Engrs., Vol. 52: 325-364. 1940.

"The characteristics and utilization of the David W. Taylor Model Basin circulating water channel." C. A. Lee. Proc. Third Hydraulics Conference, Iowa Institute of Hydraulic Research, State University of Iowa, Iowa City, Ia.

(175) VARIABLE PRESSURE WATER TUNNELS.

(b) Laboratory project. (c) W. F. Brownell, C. A. Lee.

(e) The design, construction, and calibration of a variable pressure water tunnel to be used as a test facility.

(f) To provide a jet of water approximately 60 inches in diameter and traveling at a speed of 50 knots. Provisions will be made to vary the pressure of the jet from pressures approaching vapor pressure to at least 4 atmospheres.

(g) A search of literature on all existing water tunnels has been made. Many of the existing tunnels have been visited by the Director and members of the Taylor Model Basin staff. A search of literature has been made on the component parts of the tunnel such as contraction, diffuser, guide vanes, pumping plant, etc. Studies are in progress on guide vanes and elbows at the St. Anthony Falls Hydraulic Laboratory, University of Minnesota. A 1:10 scale model is under construction at St. Anthony Falls and will be completed and ready for test in the near future. The Iowa Institute of Hydraulic Research is conducting tests on the degree of turbulence produced by screens and grids and the effect of model size on the jet of a water tunnel. The Taylor Model Basin is designing a 1:4 scale model which will have an operating speed of 50 knots and have the same variation in pressure as the full-scale water tunnel. Special attention is being directed toward the design of a test section which will be readily removable.

(h) A three volume bibliography of existing water tunnels and a five volume hydraulic design study have been completed. Preliminary plans and specifications for the mechanical, structural, and electrical designs are nearing completion.

(i) Reports and papers on all known water tunnels as mentioned in (h) are available for study and will be furnished to interested parties upon request.

See Project No. 105, University of Minnesota, and Project No. 73 and No. 80, State University of Iowa.

(176) MODEL TEST INVESTIGATION OF STREAMLINED GUN SHIELDS FOR 5-INCH GUN MOUNTS.

(b) Bureau of Ordnance, Navy Dept. (c) R. S. Gerthune, J. Wehausen, C. A. Lee.

(e) Theoretical and experimental for design and for general information.

(f) To determine the best shield shape to resist damage due to water-wave impact as occurs on the forward gun turret of the 692 class destroyer. To review and to supplement the literature on water-impact pressure and on water-wave impact phenomena.

(g) Attempt by mathematical and analytical means to predict water-impact pressure and to predict the change in pressure distribution with time when bodies of simple shape are dropped into water. Conduct drop tests with bodies of simple shape and with model gun shields to determine experimentally the magnitude and variation of the water-impact pressure. The bodies dropped will be equipped with either piezoelectric gages or diaphragm type strain gages for the purpose of pressure measurement. Conduct ship model tests to learn more about the wave phenomena when waves strike a ship in motion into the waves.

(h) Experimental equipment for conducting the laboratory tests is being designed and constructed.

(i) "Uber Stoss-und Gleitvorgänge an den Oberflächen von Flüssigkeiten." H. Wagner. Zeit. für Angew. Math. u. Mech. 12: 193-215. 1932.

"On the impact of a heavy body upon the surface of an incompressible fluid." L. I. Sedov. C.A.H.I. 187. 1934. (Russian.)

"Resistance of impact on water surface." Shumpei Watanabe.

Sci. Papers, Inst. Phys. Chem. Res., Tokyo, 12: 251-267. 1930. 14: 153-168. 1930. 23: 118-135, 202-208, 249-255. 1933-34.

"Force and pressure measurements on V-shapes on impact with water compared with theory and seaplane alighting results." E. T. Jones and R. W. Blundell. Reports & Memo No. 1932. 1938.

"Der Eindringwiederstand von Körpern mit verschiedenen Kopfformen bei senkrechten Aufschlag auf Wasser." A. Weible. Deutsche Luftfahrtforschung, UM 4541. 1943.

(177) BENTONITE CHANNEL.

(b) Laboratory project. (c) B. Rosenberg, C. A. Lee.

(e) Experimental research.

(f) To develop a new means for quantitative and qualitative studies of flow around underwater bodies.

(g) By utilizing the double refraction properties of flowing colloidal solutions of Bentonite clay, photographs showing the viscous shear pattern around an underwater body can be obtained. A technique using polarized light to obtain the shear pattern in the flowing colloidal solution will be used. The shear patterns will be studied and by numerical or graphical integration the velocity distribution may be obtained. Preliminary investigations will be two-dimensional in character, but later it is planned to extend the scope of the investigations to three-dimensional bodies.

(h) The Bentonite channel is under construction and a preliminary report of the technique to be used is being completed.

(i) Walter Leaf. Mech. Engr. 586, September 1945.

R. Weller, D. S. Middlehurst and R. Steiner. Technical Note No. 841 NACA. February 1942.

"Advances in Colloid Science." J. T. Edsall. Interscience Publishers, New York, N. Y., Vol. 1: 269. 1942.

(178) VORTEX-EXCITED VIBRATIONS OF CIRCULAR CYLINDERS.

(b) Navy Dept. (c) L. Landweber, P. Eisenberg, M. S. Maconsky.

(e) Experimental and theoretical investigations for general information.

(f) To obtain correlations of drag, side force, and vortex configurations of vibrating cylinders, including the effect of forced vibrations on the resultant vortex formation.

(g) The preliminary phases of the project will include investigations of the relation between imposed lateral motion and the resultant drag with a time correlation of the vortex pattern behind smooth cylinders at low Reynolds numbers. The work will progress to instantaneous time correlations of the side forces, drag forces, and velocity distributions in the wake to determine the strength and geometrical configuration of vortices shed from a smooth circular cylinder. These data will then be correlated with the instantaneous pressure distribution about a vibrating cylinder. Specialized phases of the project will follow with investigations of the effect of surface roughness and more complicated shapes and modes of vibration.

A special "miniature" model basin is being designed in which tests will be made of free and forced oscillations with continuous recording of the forces. A glass test section will be used for photographing the vortex pattern at the lower Reynolds numbers. Instrumentation for velocity measurements in the wake will be considered at a later date. The pressure distributions on a vibrating cylinder will be made in the large model basins at the Taylor Model Basin.

(h) Methods of lighting and photographing the wake are being investigated. The miniature model basin and its oscillator and dynamometers are in the design stages.

U. S. NAVAL ENGINEERING EXPERIMENT STATION, Annapolis, Md.

(179) CORROSION TESTS OF PIPING, FITTINGS, AND CONDENSER TUBES.

(b) Laboratory project.

(d) Commanding Officer, U. S. Naval Engineering Experiment Station, Annapolis, Md.

(e) Experimental, for future design.

(f) To obtain information as to effect of water velocity on the corrosion rate of non-ferrous pipe materials, and to determine the influence of fittings and joint design on service life.

(g) Water from the Severn River has been pumped through piping systems under controlled conditions. A permanent naval corrosion test site is being established at Kure Beach, North Carolina, to make tests in sea water.

(h) A continuing project.

(i) Similar studies have been made of materials for propellers.

"Investigation of materials for marine propellers." William C. Stewart and W. Lee Williams. Paper presented before the annual meeting of the American Society for Testing Materials at Buffalo, N. Y., June 1946.

THE PANAMA CANAL HYDRAULIC LABORATORY, Diablo Heights, Canal Zone.

(180) HYDRAULIC MODEL OF PANAMA CANAL AT SEA LEVEL.

(b) Special Engineering Division, Department of Operation and Maintenance, The Panama Canal (laboratory project).

(c) Hydraulic Section personnel under the supervision of J. S. Meyers.

(d) The Supervising Engineer, Special Engineering Division, Diablo Heights, Canal Zone.

(e) Project is part of the Isthmian Canal Studies, 1947, authorized by Public Law 280, 79th Congress, to investigate means for increasing the security and capacity of the Panama Canal.

(f) To afford a means of checking theoretical computations of hydraulic phenomena in a sea-level canal, especially the current velocities resulting from the difference in tidal ranges of the Atlantic and Pacific Oceans at the Isthmus, and to obtain a more realistic concept of the whole project.

(g) Investigations are being conducted on a hydraulic model with undistorted scale ratio, model-to-prototype, of 1:100. The half mile long sea-level canal model reproduces the Atlantic and the Pacific entrances and follows the route of the present canal. Tides are reproduced in miniature at both entrances by electro-mechanical tide machines. Provisions have been made for testing various widths of canal, for observing effects of tributary flood flows on tidal flow in the canal, and for studying the need of tidal regulating structures in the Pacific entrance.

(h) Construction of the model has been completed recently and initial tests undertaken.

U. S. WAR DEPT., OFFICE OF THE CHIEF OF ENGINEERS, Beach Erosion Board, Washington, D. C.

Inquiries concerning projects No. 181 to 185, incl., should be addressed to The Resident Member, Beach Erosion Board, Little Falls Road, N.W., Washington, D. C.

(181) EQUILIBRIUM PROFILE OF BEACHES.

(b) Beach Erosion Board, Corps of Engineers. (c) J. M. Caldwell, F. J. Syrewicz.

(e) Experimental research.

(f) To evaluate the effect of wave form and sand grain size in determining the equilibrium profile of beaches.

(g) Clean sand is placed in the large concrete wave tank, 88 feet by 14 feet by 4 feet, at the Beach Erosion Laboratory. Waves having selected characteristics are generated therein and allowed to shape the beach to a stable profile for the particular wave being studied.

(h) One sand has been tested under a single selected wave height for three different wave lengths and wave periods. The three runs consisted in retaining the wave height constant and doubling and tripling the wave length of run 1 for runs 2 and 3. The runs were continued until an apparently stable condition of the beach resulted. Further tests are yet to be conducted, using beaches of different initial slopes and with different grades of sand.

(i) Quarterly Summary, Engineer Department Investigations in Hydraulics, Soil Mechanics, and Concrete, War Department, Corps of Engineers, Waterways Experiment Station.

(182) STUDY OF WAVE REFLECTION.

(b) Beach Erosion Board, Corps of Engineers. (c) J. M. Caldwell, L. H. Senser.

(e) Experimental Research.

(f) To determine the amount of energy absorbed by various types of beaches, bulkheads, and breakwaters when subjected to wave attack.

(g) Solitary wave crests are made to impinge upon various substances mounted in the end of the tank in which the crest is generated. The energy loss resulting from the impingement is determined.

(h) Tests are being made in a wooden flume 66 feet long and 7 inches by 10 inches in cross-section. A special type of wave generator is used to generate the solitary wave used in the study. Various substances and beach slopes are placed at one end of the tank and the energy-absorbing characteristics determined.

(i) Quarterly Summary, Engineer Department Investigations in Hydraulics, Soil Mechanics, and Concrete, War Department, Corps of Engineers, Waterways Experiment Station.

(183) SETTLING VELOCITY OF BEACH SANDS.

(b) Beach Erosion Board, Corps of Engineers. (c) M. A. Mason, E. A. Dedick.

(e) Experimental research.

(f) To develop an instrument for classifying beach sand samples according to settling velocities instead of grain size.

(g) The ultimate goal of the instrument for determining the settling velocities of sand samples is to obtain an accurate record of the velocity distribution of a representative beach sand sample. It is believed that the settling velocity of beach sand is an important parameter to consider in the analysis of beach erosion problems.

(h) Preliminary tests on the first apparatus designed indicated too much inertia effect and systematic error in the measuring system. Further studies are now under way to develop an apparatus free from these errors.

(i) Quarterly Summary, Engineer Department Investigations in Hydraulics, Soil Mechanics, and Concrete, War Department, Corps of Engineers, Waterways Experiment Station.

(184) STUDY OF MODEL SCALE EFFECTS.

(b) Beach Erosion Board, Corps of Engineers. (c) J. M. Caldwell, F. J. Syrewicz.

(e) Experimental research.

(f) To determine the laws of model similarity governing the action of waves on movable sand beaches.

(g) The study is being made in the steel flume, 42 feet by 1.5 feet by 2 feet, at the Beach Erosion Board. Conditions of wave height, wave length, wave period, beach slope and grain size are adjusted to a predetermined scale in an attempt to simulate the results of the tests obtained in the concrete

tank for the Equilibrium Profile Study (Project No. 181).

(h) Tests have been conducted, using scales of 1:2 and 1:2.5. Further tests are in progress utilizing other sand size ratios and other scale representation.

(i) Quarterly Summary, Engineer Department Investigations in Hydraulics, Soil Mechanics, and Concrete, War Department, Corps of Engineers, Waterways Experiment Station.

(185) STEEL SHEET PILING INVESTIGATION.

(b) Beach Erosion Board, Corps of Engineers. (c) C. Ross (report)

(e) Experimental research.

(f) To determine the probable life of a steel sheet piling installed under variable conditions, and the causes of failure and methods of prevention.

(g) Thickness measurements of representative steel sheet piling samples located along the East Coast were taken in 1936, 1940, and 1946. Measurements were taken above high water, at high water, between high and low water, and at low water. When available, data on salinity, pH, water temperature, and pollution were also compiled.

(h) The data obtained have been compiled and are in the final stage of analysis.

(i) Quarterly Summary, Engineer Department Investigations in Hydraulics, Soil Mechanics, and Concrete, War Department, Corps of Engineers, Waterways Experiment Station.

U. S. WAR DEPT., CORPS OF ENGINEERS, LOS ANGELES DISTRICT HYDRAULIC LABORATORY, Los Angeles 14, Calif.

Inquiries concerning Projects No. 186 to 188, incl., should be addressed to The District Engineer, Los Angeles District, Corps of Engineers, 751 South Figueroa Street, Los Angeles 14, Calif.

(186) SUPERELEVATED FLOW IN CURVED OPEN CHANNELS.

(b) War Dept., Corps of Engineers, Los Angeles District.

(c) Hydraulic Design Unit, A. P. Gildea, Chief. (e) Experimental.

(f) To provide design criteria for high velocity flow in curved rectangular channels.

(g) Series of model tests to check theoretical criteria for transition spirals and superelevated bottoms for rectangular channels.

(h) Work curtailed at present. No immediate resumption contemplated.

(i) "Interim Report, Hydraulic model study, superelevated flow in curved open channels." U. S. Engineer Office, Los Angeles District, California, December 1945.

(187) HYDRAULIC MODEL STUDY, LOS ANGELES RIVER CHANNEL IMPROVEMENT, STEWART AND GRAY ROAD TO PACIFIC ELECTRIC RAILWAY.

(b) War Dept., Corps of Engineers, Los Angeles District.

(c) Hydraulic Design Unit, A. P. Gildea, Chief. (e) Design.

(f) To determine confluence losses and water surfaces for various types of bridge construction (clear span, multiple span, size and shape of piers).

(g) A 1:50 scale model of the entire channel improvement under consideration has been constructed and measurements made to determine water-surface profiles at the confluence with Rio Hondo and at the various bridges.

(h) Tests have been completed. Data are being analyzed.

(i) Report will be prepared in the near future.

(188) HYDRAULIC MODEL STUDY, LOS ANGELES RIVER CHANNEL IMPROVEMENT, WHITSETT AVENUE TO TUJUNGA WASH.

(b) War Dept., Corps of Engineers, Los Angeles District.

(c) Hydraulic Design Unit, A. P. Gildea, Chief. (e) Design.

(f) To determine effect on water surface of series of curves and reverse curves with transition spirals and superelevated bottoms for rectangular channels with various discharges. Also to determine flow conditions at the confluence with Tujunga Wash for various combinations of discharges.

(g) A 1:30 scale model of a portion of the upper Los Angeles River channel improvement under consideration has been constructed. Depth and velocity distribution measurements to be taken.

(h) Tests have been partially completed. Work curtailed at present. No immediate resumption contemplated.

U. S. WAR DEPT., CORPS OF ENGINEERS, PORTLAND DISTRICT, Portland, Ore. (Bonneville Hydraulic Laboratory).

Inquiries concerning Projects No. 189 to 192, incl., should be addressed to The District Engineer, 628 Pittock Block, Portland 5, Ore.

(189) GENERAL MODEL STUDY OF McNARY DAM, COLUMBIA RIVER, UMATILLA, OREGON.

(b) War Dept., Corps of Engineers, Portland District, Portland, Ore.

(c) R. B. Cochrane, Head, Hydraulic Design Section, Portland District.

(e) Experimental, design.

(f) Experimental study to assist in structure alignment and design of navigation approaches, fishway approaches and fishways, powerhouse tailrace, and cofferdams.

(g) A fixed bed concrete type 1:100 scale undistorted model, covered by an 85-foot by 220-foot shelter, reproduces a 3.7-mile reach of the Columbia River. After verification of natural river bed conditions, the powerhouse, spillway, lock, and fishway structures were installed, and are being tested under various conditions to determine the best alignment and design of those structures. Provisions have been provided to obtain water surface elevations, velocities, current directions, and photographs at flows ranging from 40,000 to 2,200,000 cfs for comparison purposes.

(h) Verification tests on 1:100 scale model have been completed and preliminary report issued. Tests are under way on structure alignment and powerhouse tailrace design.

(190) MODEL STUDY OF McNARY DAM SPILLWAY, COLUMBIA RIVER, UMATILLA, OREGON.

(b) War Dept., Corps of Engineers, Portland District, Portland, Ore.

(c) R. B. Cochrane, Head, Hydraulic Design Section, Portland District.

(e) Experimental, design.

(f) Experimental study to determine the hydraulic characteristics of the spillway structure, including crest shape, pier design, gates, and stilling basin details.

(g) A 1:36 scale model of plexiglass and waterproofed plywood will reproduce three complete 50-foot width bays of the spillway section, including crest, piers, gates, and stilling basin. The model will be in a brick and glass flume 5 feet wide, 6 feet high, and 70 feet long. Provision will be made for obtaining water surface profile, velocities, and pressures under various condition of head on the gates up to 50 feet. An auxiliary 1:10 scale sectional model of the proposed vertical lift gate is contemplated for the future.

(h) Construction of the 1:36 scale sectional model is currently under way and nearing completion.

(191) MODEL STUDY OF McNARY DAM NAVIGATION LOCK, COLUMBIA RIVER, UMATILLA, OREGON.

(b) War Dept., Corps of Engineers, Portland District, Portland, Ore.

(c) R. B. Cochrane, Head, Hydraulic Design Section, Portland District.

(e) Experimental, design.

(f) Experimental study to determine the hydraulic design features of the navigation lock filling and emptying systems.

(g) The lock hydraulic system will be investigated in a 1:25 scale model constructed of waterproofed plywood and transparent plastics. A section of the forebay, the entire 86-foot by 500-foot lock, and lower lock approach channel have been simulated, as well as the ports, culverts, and control valves of the filling and emptying systems. Provision will be made to operate the valves electrically and to obtain hawser stresses through a range of head conditions up to 92 feet. A separate 1:20 scale auxiliary model has been constructed to facilitate valve design.

(h) Construction is under way on the main lock model. An eccentric-seal, steel-case-enclosed tainter valve is being tested in the auxiliary 1:20 valve model.

(192) (1334) MODEL STUDY OF SPILLWAY AND OUTLET WORKS, DORENA DAM, ROW RIVER, OREGON.

(b) War Dept., Corps of Engineers, Portland District, Portland, Ore.

(c) R. B. Cochrane, Head, Hydraulic Design Section, Portland District.

(e) Experimental, design.

(f) The model was constructed to a scale of 1:50, and the converging chute spillway was constructed of plywood, the tower intake and culvert of the outlet works of pyralin, and the forebay, dam section, and tailbay of concrete. The revised non-converging chute spillway and five sluice outlets were constructed in pyralin with a plywood stilling basin. Data were obtained on crest coefficient, shape of abutment, baffle size and arrangements, stilling basin floor elevation, and the broad type of end sill.

(g) The initial purpose of the study was to determine the hydraulic characteristics of the spillway and outlet works as originally designed, and to develop means of correcting any undesirable features. The second phase of the study was made to investigate hydraulic features of the revised spillway design with special emphasis on designing stilling basin and broad end sill to obtain hydraulic j ↄ at maximum discharge under deficient tailwater conditions.

(h) Testing of the converging type spillway and tower culvert type of outlet works of the original design have been completed, and Bonneville Hydraulic Laboratory Report No. 11-1 issued on November 16, 1942. Construction has been completed and tests are in progress on baffle size and arrangement, end sill elevation, and stilling basin floor elevation of the revised non-converging chute spillway.

U. S. WAR DEPT., CORPS OF ENGINEERS, ST. PAUL DISTRICT, St. Paul 1, Minn.

Inquiries concerning Projects No. 193 to 198, incl., should be addressed to The District Engineer, Corps of Engineers, War Dept., St. Paul 1, Minn.

(193) AIRFIELD DRAINAGE STRUCTURES INVESTIGATION.

(b) Office, Chief of Engineers, Corps of Engineers, War Dept., Washington, D. C.

(c) Corps of Engineers' staff. (e) Design project.

(f) To determine the hydraulic characteristics of paved airfield gutters under various conditions of roughness, surface texture, and gradients; to determine discharge characteristics of typical commercial inlet gratings and the most efficient layout for various conditions of surface; and to determine discharge characteristics of curb inlets for various approach slopes.

(g) The investigation will be conducted in three full-scale models simulating: (1) a portion of pavement slab and gutter of concrete poured in successive courses to produce gradients of 0.25, 0.75, 1.0, 1.5, and 2.0 percent; (2) various types of commercial inlet gratings; and (3) curb gutter intakes.

(h) Design of the models has been started. The site for the model of pavement slab and gutter has been prepared.

(194) A STUDY OF METHODS USED IN MEASUREMENT AND ANALYSIS OF SEDIMENT LOADS IN STREAMS.

(b) Federal Inter-Agency River Basin Committee, Sub-committee on Sedimentation.

(c) Representatives of cooperating agencies.

(e) Experimental and design project.

(f) To improve the methods and equipment used in the measurement and analysis of the sediment load in streams.

(g) After a survey was made of previously used suspended sediment sampling equipment, field technique, and laboratory methods, improved designs of point-integrating and depth-integrating sediment samplers were built and new laboratory methods were developed. The new samplers were sent to offices of the cooperating agencies throughout the country for extensive field tests. On the basis of these tests, improvements have been made in the mechanical operation of the point-integrating sampler, and a program has been initiated to develop depth-integrating samplers to cover a wider range of sampling conditions.

(h) The testing program is in progress.

(i) Progress reports have been issued as follows:

"Field practice and equipment used in sampling suspended sediment." CE-A No. 1. August 1940.

"Equipment used for sampling bed load and bed material." CE-A No. 2. September 1940.

"Analytical study of methods of sampling suspended sediment." CE-A No. 3. November 1941.

"Methods of analyzing sediment samples." CE-A No. 4. November 1941.

"Laboratory investigations of suspended sediment samplers." CE-A No. 5. December 1941.

"A study of new methods for size analysis of suspended sediment samples." CE-A No. 7. June 1943.

"Density of sediments deposited in reservoirs." CE-A No. 9. November 1943.

"Field conferences on suspended sediment sampling". Martin E. Nelson. September 1944.

"Progress report, Comparative field tests on suspended sediment samplers." Martin E. Nelson and Paul C. Benedict. December 1944.

"Study of methods used in measurement and analysis of sediment loads in streams." Martin E. Nelson and Paul C. Benedict. Paper presented at the annual convention of American Society of Civil Engineers, Spokane, Wash. July 1946.

(195) OHIO RIVER, FILLING AND EMPTYING SYSTEMS FOR NEW CUMBERLAND LOCKS.

(b) Pittsburgh Pennsylvania District, Corps of Engineers, War Dept.

(c) Corps of Engineers' staff. (e) Design project.

(f) To check the proposed design of the filling and emptying systems for the New Cumberland main and auxiliary locks and to develop improvements in the syetems.

(g) 1:25 scale models have been built to simulate the design of a main lock 110 feet wide by 1200 feet long, and an auxiliary lock 110 feet wide by 600 feet long. The normal lift is 22.1 feet. To reduce chamber turbulence, revisions have been made or proposed in the design of chamber ports of the side-filling system for the main lock and in the design of the laterals of the bottom-filling system of the auxiliary lock. Investigations have been made of the currents in the forebay of the main lock and turbulence in the tailbays of both locks.

(h) Design and construction of the models have been completed. The testing program was in progress when work on this project was temporarily suspended.

(196) MISSISSIPPI RIVER, FILLING AND EMPTYING SYSTEM FOR NEW 1200-FOOT LOCK AT LOCK AND DAM NO. 19, KEOKUK, IOWA.

(b) Rock Island Illinois District, Corps of Engineers, War Dept.

(c) Corps of Engineers' staff. (e) Design project.

(f) To study the design of the proposed filling and emptying systems for a new 1200-foot lock at Lock and Dam No. 19, including the use of a submergible tainter gate as the upper lock gate to supplement the filling system.

(g) A 1:25 scale model simulates a lock 110 feet wide by 1200 feet long with intermediate gates to provide 800-foot and 400-foot chambers. The normal lift is 38.2 feet. The upper lock gate is used to supplement the bottom-filling system for the 1200-foot and 800-foot chambers. For the 400-foot chamber the bottom filling system is connected to an intake manifold in the downstream half of the 800-foot chamber. Emptying system consists of stub culverts discharging into either the open river or the tailbay. Extensive tests were made on the land wall emptying system to eliminate low pressures downstream from the valve. Filling tests were run in the 1200-foot and 800-foot chambers to coordinate operations of the culvert valves and the tainter service gate.

(h) Design and construction of the model have been completed. The testing program is in progress.

(197) MISSISSIPPI RIVER, FILLING AND EMPTYING SYSTEMS FOR AUXILIARY LOCKS.

(b) St. Paul, Minnesota, District, Corps of Engineers, War Dept.

(c) Corps of Engineers' staff. (e) Design project.

(f) To obtain data for use in the design of the filling and emptying systems for the unfinished auxiliary locks under a range of heads for systems composed of a single wall culvert and floor laterals of various dimensions, number, and spacing. It is anticipated that the results will be of such scope as to be applicable also to the design of locks in other navigation projects.

(g) Tests were made in a 1:25 scale model simulating a lock 110 feet wide and 360 feet long, usable dimensions. The culvert system, from the intakes to a section about 127 feet downstream from the miter gate pintles, simulated a representative design of the systems used in the 20 existing auxiliary locks.

(h) The draft of the final report has been completed. Publication has been suspended indefinitely due to curtailment of funds.

(198) MISSISSIPPI RIVER, FILLING AND EMPTYING SYSTEM FOR LOCK NO. 27, ST. LOUIS, MISSOURI.

(b) Upper Mississippi Valley Division, Corps of Engineers, War Dept., St. Louis, Mo.

(c) Corps of Engineers' staff. (e) Design project.

(f) To check the design of the proposed filling and emptying systems for Lock No. 27, and to investigate current conditions in the upstream and downstream lock entrances.

(g) After tests were completed on models of the main and auxiliary locks, design lengths were changed from 600 feet to 1200 feet for the main lock and from 360 feet to 600 feet for the auxiliary lock. Another model was built to the scale of 1:25 to simulate the 1200-foot main lock, but the revised design for the auxiliary lock was made without further model study. The side filling system for the 1200-foot main lock was supplemented by flow over a vertical-lift gate installed at the upper lock gate, and longitudinal culverts of the side-emptying system were supplemented by a stub culvert at the lower gate. Filling tests were made to coordinate the operations of the vertical-lift gate and culvert valves and emptying tests were made with different outlet arrangements to reduce turbulence and currents in the tailbay.

(h) Tests have been completed. The final report is being prepared.

U. S. WAR DEPT., CORPS OF ENGINEERS, U. S. WATERWAYS EXPERIMENT STATION, Vicksburg, Miss.

Inquiries concerning Projects No. 199 to 259, incl., should be addressed to The Director, U. S. Waterways Experiment Station, P. O. Box 631, Vicksburg, Miss.

(199) (1339) MODEL STUDY OF STILLING BASIN, BLUESTONE DAM, NEW RIVER, WEST VIRGINIA.

(b) The District Engineer, U. S. Engineer Office, Huntington, W. Va.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of stilling basin.

(f) To determine the location of cavitation pockets around the baffle piers, and to develop moderate revisions in the present stilling-basin design in an attempt to reduce cavitation action.

(g) Bluestone Dam, on New River near Hinton, W. Va., will be a flood-control and hydroelectric power dam. Flow will be regulated by 8 sluices through the spillway; 21 vertical-lift gates surmounting the spillway will control extreme floods. The spillway is designed to pass 430,000 cfs under a head of 30 feet. A secondary or stilling weir will be placed 364 ft downstream from the axis of the dam to provide sufficient tailwater in the stilling basin for formation of a hydraulic jump. The basin will contain a 44-ft horizontal apron, two rows of baffle piers, and an end sill. The 1:36 scale section model reproduced a portion of the spillway chute, the stilling basin, and the secondary weir.

(h) All tests have been completed; preparation of final report is in progress.

(200) MODEL STUDY OF GATE SLOTS AND CONDUITS, BULL SHOALS DAM, WHITE RIVER, ARKANSAS.

(b) The District Engineer, U. S. Engineer Office, Little Rock, Ark.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of gate slots and conduits.

(f) To investigate areas of probable cavitation at the gate slots and develop the most satisfactory type of outlet portal which will permit spreading of the conduit discharge to obtain best stilling-basin performance.

(g) Bull Shoals Dam, to be located on the White River in Arkansas, approximately 115 miles north of Little Rock, Ark., and 10 miles west of Mountain Home, is one of the main units in the comprehensive plan for flood control in the White River Basin. Bull Shoals Dam will be used to control floods, generate hydroelectric power, and provide increased low-water flow for navigation. The dam will be a 2,349-ft concrete-gravity structure with an overflow spillway section located on the right side of the valley and a non-overflow section located on the left side which will contain the intakes and penstocks for supplying water to the generating units. The spillway has 17 radial crest gates, 40 ft long and 28 ft high, and is designed to pass a discharge of 556,000 cfs. Sixteen gate-controlled conduits are provided through the base of the dam in the spillway section. Two models were used originally in this study: (a) a 1:6-scale model reproducing the gate slots and a portion of the conduit cross-section; and (b) a 1:25-scale model reproducing three of the conduits and a 288-ft-wide section of the stilling basin. In order to determine if the stilling basin developed on the sluice model was satisfactory for spillway flow, however, an additional 1:60-scale section model reproducing 180 ft of the spillway was constructed.

(h) All tests have been completed; preparation of final report is in progress.

(201) MODEL STUDIES OF SPILLWAY, STILLING BASIN, AND SLUICE, CONEMAUGH DAM, CONEMAUGH RIVER, PENNSYLVANIA.

(b) The District Engineer, U. S. Engineer Office, Pittsburgh, Pa.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of spillway, stilling basin, and sluice.

(f) To determine a suitable design for stilling facilities below the spillway,

shape of crest, and allied features, and to develop an adequate design for the conduits.

(g) The Conemaugh Dam, to be located on the Conemaugh River in Indiana and Westmoreland Counties, Pennsylvania, about 7.5 miles above the junction of the Conemaugh River and Loyalhanna Creek at Saltsburg, Pennsylvania, will be one of the main units in the comprehensive plan for flood control in the Pittsburgh District. The dam will consist principally of a concrete-gravity section with an earth embankment section at the right abutment. A centrally-located spillway, designed to discharge 370,000 cfs will contain 14 crest gates, each 30 ft by 27 ft high. Normal flow will be regulated by conduits through the spillway. Two models were used originally in this study: (1) a 1:60-scale comprehensive model, reproducing the entire problem area including about 1000 ft of approach channel, the entire dam, and about 1500 ft of exit channel below the dam; and (2) a 1:24-scale section model was used to study the best design of each type stilling basin produced by tests conducted on the comprehensive model. In order to make a more complete study of sluice action, a 1:15-scale model of one of the sluices was reproduced to select the most favorable invert elevation, intake and trash-rack design, and outlet design.

(h) All tests have been completed; preparation of final report is in progress.

(202) MODEL STUDY OF STILLING BASIN, CLARK HILL DAM, SAVANNAH RIVER, GEORGIA.

(b) The Division Engineer, South Stlantic Division, Atlanta, Ga.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of stilling basin.

(f) The general purpose of the model study was to examine the hydraulic performance of the bucket as originally designed. In this connection data were desired as to the effect of varying the tailwater from the theoretical depth required for a hydraulic jump over a horizontal apron to a depth 20 percent in excess of the theoretical jump depth.

(g) The Clark Hill Dam is proposed for construction on the Savannah River about 20 miles north of Augusta, Ga. The dam will be a combined earth and concrete structure with a top elevation of 351 ft and a length of about 5660 ft. An ogee-type spillway near the center portion of the concrete dam has a gross length of 1096 ft and is designed to pass a maximum flow of 1,058,000 cfs under a head of 46 ft. Flow over the spillway will be controlled by 23 tainter gates, each 40 ft wide and 35 ft high. The energy dissipater at the toe of the spillway will be of the bucket type with a radius of 50 ft and a lip height of 14.6 ft. Provisions also are being made for the release of flow through sluices located in the spillway section and for generation of hydraulic power. The 50-ft-radius bucket of the Clark Hill Dam spillway was installed at the toe of the existing models of Stewarts Ferry Dam and Conemaugh Dam. This permitted comparison of results obtained from a 1:100-scale section model and from a 1:35-scale section model. No alterations were made to the existing crest shape and gates of the section models. The total discharge over the spillway and through the bucket was proportioned to scale in both models, and simulated the discharge per foot of width that would exist for the Clark Hill Dam conditions.

(h) All tests have been completed; preparation of final report is in progress.

(203) (1341) MODEL EVALUATION OF CAVITATION ACTION, CLAYTOR DAM, NEW RIVER, VIRGINIA.

(b) The District Engineer, U. S. Engineer Office, Huntington, W. Va.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To evaluate the pressure variations on the baffle piers of the Claytor Dam; the results of these tests are to be used as a basis for evaluating the possibility of dangerous erosion by cavitation of the Bluestone Dam baffle piers (see Project No. 199, "Model study of stilling basin, Bluestone Dam, New River, West Virginia").

(g) Claytor Hydroelectric Project is located on New River near Allisonia, Virginia. In addition to the regulation of flow for power development, flow is passed through two outlets located in the spillway and controlled

by 5-ft gate valves. Nine spillway gates are used to control extreme floods. Maximum flow over the spillway occurred during the flood of August 13-16, 1940, when a discharge of 200,000 cfs was passed over a head of 28.5 ft. The stilling arrangement below the spillway consists of a short apron with a row of baffle piers and an end sill. The 1:36-scale section model reproduced 5 central bays of the spillway and stilling basin.

(h) All tests have been completed; preparation of final report is in progress. (To be incorporated in report, "Model study of stilling basin, Bluestone Dam, New River, West Virginia".)

(204) MODEL STUDY OF DEMOPOLIS LOCK AND DAM, TOMBIGBEE RIVER, ALABAMA.

(b) The District Engineer, U. S. Engineer Office, Mobile, Ala.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To determine scouring action and flow characteristics below the stilling apron and at the lock entrances, and to devise corrective measures or improvements which may be indicated.

(g) The Demopolis Lock and Dam will be built at a site about 2 miles below Demopolis, Ala., on the Tombigbee River, and 3 miles below the existing Lock No. 4, which it will replace. It will be concrete gravity section, with a spillway extending the entire length of the dam. A single lock on the left bank end of the spillway will be provided for navigation purposes. A 1:80-scale comprehensive model reproduces 2300 ft of approach area and 2500 ft of exit channel, the full width of the channel and overflow area, the spillway, stilling basin, and locks. A 1:40-scale section model of the spillway reproduces a 40-ft section of the spillway and stilling basin and a portion of the exit channel.

(h) All tests have been completed; preparation of final report is in progress.

(205) MODEL STUDY OF SPILLWAY AND CONDUITS, DETROIT DAM, NORTH SANTIAM RIVER, OREGON.

(b) The District Engineer, U. S. Engineer Office, Portland, Ore.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of spillway and conduits.

(f) To analyze the hydraulic characteristics of the spillway and stilling basin, and the flood-control conduits; and to develop means of correcting any uneconomic, unsafe, or otherwise undesirable conditions which may exist in the proposed design of these structures.

(g) Detroit Dam, to be located near Detroit, Ore., is one of seven multiple-use dams to be built on the main tributaries of the Willamette River. Detroit Dam will operate in parallel with the other dams to reduce flood heights on the main stream, to provide increased low-water flow for navigation or irrigation, and to generate hydroelectric power. An ogee-type spillway near the center portion of the 1580-ft concrete dam is designed to pass a maximum flow of 157,000 cfs at a head of 30.4 ft. Originally, four 64-ft-wide by 28-ft-high radial crest gates were designed to control extreme floods. However, latest plans call for 6 gates, 42-ft wide by 28-ft high. Revised plans also call for two 72-inch circular conduits at elevation 1265 controlled by 72-inch hollow jet valves located approximately 42 ft from the upstream face discharging into free flowing conduits leading to the downstream face of the dam, and six 5-ft-8-inch by 10-ft-0-inch rectangular conduits, three at elevation 1340 and three at elevation 1391, controlled by hydraulically-operated slide gates discharging at the downstream face of the dam. Three 15-ft-0-inch diameter penstocks located to the right of the spillway will conduct flow to the power turbines. Two models are involved in this study: (1) a 1:60-scale general model reproducing the spillway and stilling basin, the dam, the 5 flood-control conduits, and the power structures; and (2) a 1:15-scale model of the flood-control conduits.

(h) The spillway tests are in progress; the model of the conduit is under construction.

(206) MODEL STUDY OF SPILLWAY, DILLON DAM, LICKING RIVER, OHIO.

(b) The District Engineer, U. S. Engineer Office, Huntington, W. Va.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of spillway.

(f) To determine (a) extent and magnitude of any destructive eddies which may be formed near the toe of the dam when the spillway is in use and to devise corrective measures therefor; and (b) whether the ogee-type spillway with its deeper channel will provide better performance over the less expensive plan of using a broad-crested spillway.

(g) Dillon Dam, to be located on Licking River, Ohio, will be a rolled earth-filled structure with an uncontrolled spillway located in the left abutment. Controlled flow regulation will be provided by an outlet works located in the right abutment. The outlet works, with a capacity of 7000 cfs at conservation pool level, will consist of a three-gated intake (each gate 7 ft wide by 15 ft high), a 551-ft horseshoe-shaped conduit, and a stilling basin. A 1:50-scale model reproduces 1000 ft of the approach area and 1800 ft of exit channel, the full width of the dam and spillway area and the controlling conduit with gates and stilling basin.

(h) Testing is in progress.

(207) MODEL STUDY OF SLUICES, FALL RIVER DAM, FALL RIVER, KANSAS.

(b) The District Engineer, U. S. Engineer Office, Tulsa, Okla.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of sluices.

(f) (a) To determine the adequacy of the present sluice design; (b) to determine whether artificial means of spreading the flow as it emerges from the sluices is necessary; and (c) to develop the most suitable design for the sluices.

(g) The dam consists of an earth-fill embankment spanning the valley with a concrete spillway structure in the river channel near the right abutment. The spillway is of the gravity, ogee-weir type with eight 50-ft by 25-ft high tainter crest gates. Normal flow regulation is afforded by seven 5-ft by 8-ft-6-inch sluices through the spillway weir, one along the centerline of each of the spillway piers. A 1:20-scale sluice model reproduces a portion of the pool area, three sluices, a 256-ft wide section of the stilling basin and 200 ft of the exit channel.

(h) All tests have been completed; preparation of the final report is in progress.

(208) MODEL STUDY OF SPILLWAY, ENID DAM, YOCONA RIVER, MISSISSIPPI.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To examine the hydraulic performance of the proposed combined structure with especial reference to the capacity, hydraulic safety, and effect of the sloping side walls on the hydraulic performance of the structure.

(g) Enid Reservoir, one of several flood-control works planned to furnish flood protection to the Yazoo River Basin above the head of the Mississippi River backwater area, will be located approximately 3 miles north of Enid, Miss. The proposed dam is an earth-fill structure with an uncontrolled chute-type spillway having a crest length of 200 ft and designed to pass a flow of 49,700 cfs under a head of 16 ft. Flow regulations will be afforded by conduits through the spillway section. An unusual feature of this dam will be the flat slope of the concrete side walls extending the full length of the spillway; the flat slope is necessary since the walls are designed to be constructed of concrete with no reinforcing steel. The 1:30-scale model reproduces about 450 ft of approach channel, the spillway, the intake tower and conduits (schematically), and about 450 ft of the exit channel.

(h) All tests have been completed; preparation of final report is in progress.

(209) MODEL STUDY OF SLUICES, FORT GIBSON DAM, GRAND (NEOSHO) RIVER, OKLAHOMA.

(b) The District Engineer, U. S. Engineer Office, Tulsa, Okla.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of sluices.

(f) To determine the adequacy of the proposed sluice designs.

(g) Fort Gibson Reservoir, to be located on the Grand (Neosho) River, Okla., will be used for the dual purpose of flood control and development of hydroelectric power. The dam will be a concrete-gravity type structure with an overall length of approximately 2850 ft. A 1490-ft concrete ogee-type spillway, located within the dam section, is designed to pass 919,000 cfs at a head of approximately 35 ft. The spillway discharge will be controlled by thirty 40-ft tainter gates surmounting the spillway crest. Normal flow regulation is afforded by ten 5-ft-8-inch by 7-ft sluices through the spillway proper. a 1:20-scale model reproducing a portion of the pool area, five sluices, a 256-ft-wide section of the stilling basin, and 200 ft of the exit channel.

(h) All tests have been completed; preparation of final report is in progress.

(210) MODEL STUDY OF INTAKE STRUCTURES, GARRISON DAM, MISSOURI RIVER, NORTH DAKOTA.

(b) The District Engineer, U. S. Engineer Office, Bismarck, N. D.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of intake structures.

(f) To develop the most suitable intake design by (a) vacuum tests to determine location of critical areas which might be subjected to cavitation pressures; and (b) tests under atmospheric pressures to determine head losses through the intake.

(g) Garrison Dam will consist of an earth embankment rising approximately 185 ft above the valley of the Missouri River upstream from Bismarck, N. D. Eight power conduits and five flood-control sluices will be located in the right abutment. A chute-type spillway in the left abutment will be designed to pass a flood flow of 600,000 cfs. The study is being conducted on a model, scale of 1:30, reproducing a portion of the intake structure and one sluice including the intake throat, trash-rack, bulkhead, emergency and service gate slots, one service gate, air vent, and transition section.

(h) Testing is in progress.

(211) MODEL STUDY OF OUTLET STRUCTURES, GARRISON DAM, MISSOURI RIVER, NORTH DAKOTA.

(b) The District Engineer, U. S. Engineer Office, Bismarck, N. D.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of outlet structures.

(f) To develop a stilling device for the power conduits, which will be used for diversion during construction of the dam. that can later be incorporated into the powerhouse substructure, and to develop a sluiceway stilling basin.

(g) Garrison Dam will consist of an earth embankment rising approximately 185 ft above the valley of the Missouri River upstream from Bismarck, N. D. Eight power conduits and five flood-control sluices will be located in the right abutment. A chute-type spillway in the left abutment will be designed to pass flood flow of 600,000 cfs. The study is being conducted upon a model, scale of 1:45, reproducing about 300 ft of the lower portion of the power conduits and sluiceways, the entire tailrace area and stilling basin below the sluiceways, and about 1000 ft of the exit area below the stilling basin.

(h) Testing is in progress.

(212) MODEL STUDY OF HARLAN COUNTY DAM, REPUBLICAN RIVER, NEBRASKA.

(b) The District Engineer, U. S. Engineer Office, Kansas City, Mo.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To study possible erosive currents along the left training wall and eddy action along the toe of the dam.

(g) The dam consists of a rolled-fill embankment section and a gravity-type concrete overflow structure including the gate-controlled spillway, the flood-control outlet works, irrigation outlets, bulkhead section to effect connections with the earth embankment, and provision for future power installation. The spillway, 876 ft in width, is controlled by 18 crest gates, each 30 ft high by 40 ft wide. The spillway structure includes 10 sluices,

each 5 ft wide and 8 ft high. The 1:80-scale model reproduces about 2,000 ft of approach channel, the spillway, the sluices, the stilling basin, and about 4,400 ft of the exit channel.

(h) All tests have been completed; preparation of final report is in progress.

(213) MODEL STUDY OF CONTROL STRUCTURE, MORGANZA FLOODWAY, LOUISIANA.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of control structure.

(f) To determine discharge coefficients and to investigate head-discharge relationships, effect of stilling-basin design on the hydraulic jump, and effect of crest shape on hydraulic efficiency.

(g) Morganza Floodway Control Structure will consist of an ogee-type spillway and a stilling basin, the design of which will be governed by the results of model tests. 191 gatebays, each 23 ft wide, will control flood flows through the Morganza Floodway. The 1:16-scale model will reproduce about 250 ft of approach area and 500 ft of exit area, the five gate bays on the right end of the structure, and a portion of the right training wall.

(h) Design of model is in progress.

(214) MODEL STUDY OF SPILLWAY AND STILLING BASIN, OSCEOLA DAM, OSAGE RIVER, MISSOURI.

(b) The District Engineer, U. S. Engineer Office, Kansas City, Mo.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of spillway and stilling basin.

(f) To confirm design assumptions and to arrive at the most feasible and economical stilling-basin design.

(g) The dam consists of a rolled-fill earth embankment section and a gravity-type concrete overflow structure including the gate-controlled spillway, the flood-control and navigation conduits, bulkhead sections to effect connection with the earth embankment, and provision for future power installation. The spillway is 760 ft in width and is controlled by 16 crest gates (each 30 ft high and 40 ft wide). The spillway structure includes 15 sluices (each 5 ft wide and 8 ft high). The 1:60-scale model reproduces about 900 ft of approach channel, the spillway, the sluices, the stilling basin, and about 1500 ft of the exit channel.

(h) Testing is in progress.

(215) MODEL STUDY OF SPILLWAY, STEWARTS FERRY DAM, STONES RIVER, TENNESSEE.

(b) The District Engineer, U. S. Engineer Office, Nashville, Tenn.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of spillway and stilling basin.

(f) To analyze the hydraulic characteristics of the spillway and the stilling basin and to develop means of correcting any uneconomic, unsafe, or otherwise undesirable conditions which may exist in the proposed design.

(g) The dam is a composite-type structure consisting of rolled-fill earth embankment sections and of a gravity-type concrete section containing the spillway and powerhouse intakes. The 328-ft spillway containing 7 crest gates (each 26 ft high and 40 ft wide) is designed to pass a maximum discharge of 199,000 cfs under a head of 32.5 ft. Low flows will be regulated by 5 sluices (each 10 ft high and 5 ft 8 inches wide) through the spillway section. A bucket-type stilling basin will dissipate the energy contained in the spillway flow. A 1:80-scale model reproduces about 1,400 ft of approach channel, the spillway, the sluices, the bucket-type energy dissipator, a portion of the dam, and about 2,200 ft of exit channel.

(h) All tests have been completed; preparation of final report is in progress.

(216) MODEL STUDY OF IRRIGATION TUNNEL, ST. MARY DAM, SASKATCHEWAN, CANADA.

(b) The Chief Engineer, Prairie Farm Rehabilitation, Dept.of Agriculture, Saskatchewan, Canada.

(o) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To check the hydraulic characteristics of the irrigation tunnel and to develop means for correcting any uneconomic, unsafe, or undesirable conditions which are found to exist in the proposed design.

(g) St. Mary Dam is to be a unit in the St. Mary-Milk Rivers Project, by which it is proposed to develop some 345,000 acres of irrigated land in addition to providing a better water supply for existing irrigation districts comprising some 120,000 acres. A rolled fill dam with a crest length of about 2,400 feet will rise 190 feet above the valley floor. A cut through the summit of a ridge will serve as a spillway and will conduct flood flows to a coulee roughly paralleling the river to the north. A tunnel through the hill to the south of the dam will conduct irrigation water from the reservoir. This tunnel has been designed to pass a maximum discharge of 3,200 cfs with the head varying from a minimum of 25 feet to a maximum of 81 feet. A 1:25-scale model will reproduce approximately 200 feet of approach channel, the intake structure, including the service gates, transition from the intake to tunnel, the tunnel, the outlet transition, and about 300 feet of exit channel.

(h) Construction of the model is in progress.

(217) MODEL STUDY OF SPILLWAY AND BUCKET IN SECTION, WHITNEY DAM, BRAZOS RIVER, TEXAS.

(b) The District Engineer, U. S. Engineer Office, Galveston, Tex.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of spillway and bucket.

(f) To analyze the hydraulic characteristics of the spillway and stilling basin, and to develop means of correcting any uneconomic, unsafe, or otherwise undesirable conditions which may exist in the proposed design.

(g) The dam as proposed consists of an 824-ft ogee-type spillway near the center portion of the 1680-ft concrete structure designed to pass a maximum flow of 660,000 cfs at a head of 40 ft. The spillway contains 17 tainter gates (each 38 ft high by 40 ft wide) and 16 flod-control conduits (each 9 ft high by 5 ft wide). A 200-ft horizontal stilling basin with baffle piers and end sill will dissipate the energy contained in spillway flow. A 1:30-scale section model reproduces one entire bay of the spillway and two adjacent half bays, a portion of the approach channel, the bucket or horizontal apron, three sluices, and a portion of the exit channel.

(h) Testing is in progress.

(218) MODEL STUDY OF CONDUIT ENTRANCES.

(b) Office, Chief of Engineers, U. S. Army, Washington, D. C.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of conduit entrances.

(f) To collect experimental data on which to base the hydraulic design of conduit entrances for conduit alignments at various angles to the upstream face of a dam.

(g) Models, 1:20-scale, of six intakes for a 5-ft-8-inch by 10-ft-0-inch conduit were fabricated of plastic and attached to a steel pressure tank for testing. The intakes tested were for conduit alignments normal to the face of the dam and at angles of 10, 20, 30, and 40 degrees from the normal to the face of the dam.

(h) All tests have been completed; preparation of final report is in progress.

(219) MODEL STUDY OF SLUICE GATES.

(b) Office, Chief of Engineers, U. S. Army, Washington, D. C.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of sluice gates.

(f) To determine the best shape gate lip to reduce the downward hydraulic pull on

the gates and any vibration tendencies during the opening or closing procedure.

(g) A 1:6-scale model will reproduce the gate slots, the sluice gate, a portion of the conduit upstream and downstream from the gate section, and the air vents.

(h) Testing is in progress.

(220) MODEL STUDY OF SUCTION HEAD, DREDGE JADWIN.

(b) The District Engineer, U. S. Engineer Office, Memphis, Tenn.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of dredge suction heads.

(f) To investigate the design of the new types of suction heads, and to obtain data and information on the operation of the old and new types of heads which will aid in improving the design and efficiency of a new suction head.

(g) The model reproduces dredging operations using a bed of sand which may be varied to correspond to pre-maintenance and maintenance dredging conditions. Comparison tests are also being made using clear water. The model is constructed undistorted to the linear scale ratio, model to prototype, of 1:10. The model consists of a flume with a sand bed spanned by a movable carriage supporting a suction head and pumps. The discharge from the suction line is spoiled into a settling basin where the rate of flow and percent of solids can be measured.

(h) All tests have been completed; preparation of final report is in progress.

(221) PROTOTYPE CONFIRMATION OF MODEL STUDIES.

(b) The Director, U. S. Waterways Experiment Station, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) General information.

(f) To obtain, from already accumulated data and from future prototype observations, material to be analyzed and tabulated for subsequent interpretations. The ultimate aim of the investigation is to aid the engineer in evaluating results obtained from small-size studies, as well as to advance the science of model investigations.

(g) Inquiries have been addressed to departmental offices enlisting their cooperation in furnishing background material such as plans and specifications, construction progress photographs, construction status, changes in design, and any measured prototype performance data. In the case of projects in the final stages of construction and for which no means of obtaining hydraulic data have been provided, plans have been made for procuring such data as is possible. For projects which have been recently initiated, the faasibility for prototype measurements will be determined, and plans formulated for the installation of equipment for making hydraulic observations.

(h) Prototype data are being obtained.

(222) MODEL STUDY OF PONTONS FOR THE M5 BRIDGE.

(b) The Executive Officer, the Engineer Board, Fort Belvoir, Va.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To study the effect of adding the rectangular center section to the M4 pontons in the M5 bridge; to secure data on the M4 pontons in the M5 bridge; and, if possible, to improve the freeboard in high velocity flow by testing several new type bow shapes.

(g) The M4 ponton is 6 ft 10-1/2 inches wide and 29 ft 7-5/8 inches long, with a curved streamlined bow and rectangular-shaped stern. When used in an M4 type bridge, two pontons are fastened stern to stern and adjacent pairs of pontons placed at 15-ft centers. With the M5 bridge, however, a rectangular-shaped center section is added to the two pontons forming an overall length of about 81 ft. The 81-ft overall sections are spaced at 7.5 ft center to center. The models of the pontons and the M5 bridge are constructed to the

linear-scale ratio of 1:15. The deck of the M5 bridge is reproduced by a wooden frame of such construction as to reproduce the deflection characteristics of the prototype bridge under load.

(h) All tests have been completed; preparation of the final report is in progress.

(223) MODEL STUDY OF HYDRAULIC SYSTEM, NEW JERSEY SHIP CANAL LOCKS, NEW JERSEY.

(b) The District Engineer, U. S. Engineer Office, New York, N. Y.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of hydraulic system.

(f) To test the hydraulic system of the ship lock, and to make a navigability test to determine the effect of the contemplated top filling system upon vessels using the Sayreville locks.

(g) The New Jersey Ship Lock is one of three locks proposed for the Sayreville end of the New Jersey Ship Canal. The overall length of the ship lock as proposed is 960 ft with a width of 90 ft. The ship lock is to have two intermediate sets of gates, affording chambers with overall length of 350, 430, 530, 610, and 960 ft and usable lengths of 270, 350, 450, 530, and 880 ft. This lock is to have an emptying system comprised of a side culvert 21 ft 3 in. by 21 ft 3 in. with 22 laterals located in the bottom of the lock chamber, and a filling system consisting of two side culverts 15 ft by 15 ft with 90 (45 to the culvert) top filling ports. The maximum lift of the ship locks is 10 ft. A 1:20-scale model reproduced the ship lock and a small portion of the lower and upper pools. This lock was built with all appurtenances for filling and emptying, including the tainter gates in both systems operating with respect to their prototype time interval.

(h) All tests have been completed.

(224) (1150) HYDROLOGICAL RESEARCH PROJECT, EXPERIMENT STATION, LAKE WATERSHED, MISSISSIPPI.

(b) Office, Chief of Engineers, U. S. Army, Washington, D. C.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) General information.

(f) To augment pertinent data and to advance the knowledge of the hydrological characteristics of any drainage basin through a comprehensive study of the hydrology of a typical small watershed -- that of the Experiment Station Lake.

(g) The Experiment Station dam forms a small lake whose elevation is controlled by a chute-type spillway. Pertinent facts concerning the watershed are: shape, oval; area, 3,521 acres; terrain, rough and hilly; soil, loess; vegetation, pasture, cultivated land, woods; habitation, scattered. Two investigations are included in the project: (1) a study of the rainfall-runoff relation using the unit-hydrograph method; and (2) a study of evaporation. The apparatus and structures used in the project consist of: 29 nonrecording and 5 recording rain-gaging stations located at approximately half-mile intervals over the watershed; 6 inflow stream-gaging stations; two land and one floating evaporation station; six ground-water wells; and two type F and two type FA infiltrometers.

(h) Study discontinued.

(225) POTAMOLOGY STUDY.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for general information.

(f) To obtain qualitative information from laboratory streams having no direct scale relationship to any stream in nature: (a) fundamentals of meandering phenomena; (b) effect of bank stabilization on simple meandering streams consisting of a series of nearly uniform bends; (c) effect of bank stabilization on laboratory streams having the alignment of certain reaches of the Mississippi River; and (d) to conduct a study toward making true erodible bank models that will reproduce bank line changes in the river to the end that specific bank stabilization problems may be studied in the laboratory to indicate when and where stabilization works should be placed.

(g) The project has been established to obtain qualitative information on the meandering phenomena of the Mississippi River and to learn the effects of revetments and dikes on the regimen of the river. Laboratory meandering streams are developed in movable bed and erodible bank material. The early tests were conducted with a straight channel, having a curved entrance. Later tests were conducted with the initial channel having slight sinuosity throughout. The third series of tests is being conducted with the initial channel having the alignment of the river, and the fourth series of tests is being conducted with the stream molded to a definite scale relationship with the river. The data obtained during all tests consist of gage readings, hydrographic surveys, water-surface and bed profiles, photographs, and observations of bed load movement.

(h) A detailed description of the model tests and results is contained in the final report, "Laboratory study of the meandering of alluvial rivers", May 1, 1945, available on loan.

(226) MODEL STUDY OF INVESTIGATIONS FOR THE CONTROL OF BANK CAVING AND MEANDERING OF ALLUVIAL STREAMS.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for developing model techniques.

(f) To develop a model technique for the study of meandering streams with a view to determining the necessity for and the effects of bank revetment, dredging, and other regulative measures in any troublesome reach and the study of revetment to determine the causes of failures and the development of means of preventing them.

(g) Study and development of erodible bank materials and a model operating technique which will result in a model river which responds to the laws of meandering in the same degree as its counterpart in nature and which can be used to indicate the trends in regimen changes in any reach of an alluvial river and the necessity for regulative works for the improvement and stabilization of the reach. Study of various types of revetment in present use to determine causes of failures and to develop methods of overcoming them. A flume has been constructed to determine the erodibility factors of various materials which can be used to simulate bank caving of the prototype and to correlate this material with material of varying degrees of resistance to erosion as found in the prototype. The flume is 1 ft wide and 1 in. deep with a 6 ft straight section and a curved section of 5 ft radius. Provisions are made for the molding of erodible material on the outside of the bend. A typical unstable bend of the Mississippi River will be reproduced in an existing flume and studies will be made to determine scale ratios and allowable distortions which will permit the reproduction of river meandering and bank caving. The information obtained from this study will be used to design a model and model operating technique for the study of a reach involving several bends of the Mississippi River. For the study of revetment failures, it is planned to construct an 8 ft by 3 ft by 6 ft flume in which a typical section of the Mississippi River will be molded in an erodible material to an undistorted scale of 1:50 and the revetment simulated as nearly as practical to proper scale of mass strength, and dimension. This flume will be used as a preliminary step in the development of a model technique which will reproduce all forces acting upon revetment in the prototype. In conjunction with the model study, a survey will be made of revetment in the Mississippi River to obtain data which can be correlated with those obtained in the model.

(h) The construction of a flume for the determination of erodibility factors has been completed and tests are in progress. The design of the flume for the revetment study has been completed. An unstable section of the Mississippi River has been selected for the study of river meandering and channel stabilization and preparations are being made to start this phase of the study.

(227) MODEL STUDY OF FLOOD CONTROL PROJECT, BRADY CREEK, BRADY, TEXAS.

(b) The District Engineer, U. S. Engineer Office, Galveston, Tex.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for channel improvements.

(f) To study, verify, or modify the design assumptions on the capacity of the project or improved channel, water-surface elevations, slopes and velocities.

(g) The city of Brady, Tex., is located on Brady Creek 29 miles above the mouth, 173 miles southwest of Fort Worth, Tex., and 154 miles northwest of Austin, Tex. The major portion of the city of Brady, including the industrial or business district, is located on the south bank of the creek. This south bank is comparatively low and is subject to inundation by major floods. Protection of this area from floods by improving the channel and constructing a high levee along the south bank is under consideration. The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:150; vertical dimensions, 1:100. Reproduced in the model are 11,000 ft of the improved channel, approximately 600 ft of unimproved channel adjacent to the upstream end of the improved channel, and approximately 5700 ft of unimproved channel at the lower end. As the proposed improvements provide for complete protection of the city, only that portion of the city lying within the leveed flood plain is reproduced.

(h) Testing has been suspended, awaiting decision of the District Engineer relative to further tests.

(228) MODEL STUDY OF CHANNEL STABILIZATION, MISSISSIPPI RIVER, CAULK NECK TO GREENVILLE, MISSISSIPPI.

(b) The District Engineer, U. S. Engineer Office, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for channel stabilization.

(f) The project has been established to obtain qualitative information on the meandering phenomena of the Mississippi River and to learn the effects of revetments and dikes on the regimen of the river.

(g) Model study to obtain qualitative information as to past and future meandering in this reach of the Mississippi River, with a view to developing remedial and preventive measures. The model is of the movable-bed and erodible-bank type with scale ratios: horizontal dimensions, 1:2000; vertical dimensions, 1:500. Reproduced in the model are 47 miles of the main channel of the Mississippi River between Caulk Neck Cut-off and Walker Bend. To allow for sufficient meandering of the channel, the model is constructed in a wide flume. Haydite was selected as bed and bank material for reproducing the bed and bank movement of the prototype channel. The data obtained during all tests consist of gage readings, hydrographic surveys, water-surface and bed profiles, photographs, and observations of bed-load movement.

(h) Study was discontinued.

(229) MODEL STUDY OF THE MISSISSIPPI RIVER, CAIRO, ILLINOIS, TO COTTONWOOD POINT, MISSOURI.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for flood control improvements.

(f) To determine the effect of certain proposed plans for controlling floods on the Mississippi River.

(g) Study of flood-control plans for the Mississippi River. The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:2000; vertical dimensions, 1:100. Reproduced in the model are the main channel and overbank area of the Mississippi River from Grand Tower, Ill., (80 miles above Cairo, Ill.) to Cottonwood Point (134 miles below Cairo, Ill.); the Ohio River from Dam 50 (110 miles above Cairo, Ill.) to the mouth; the Cumberland River from the vicinity of Kuttawa, Ky., (42 miles above the mouth) to the mouth; the Tennessee River from the foot of Gilbertsville Dam (25 miles above the mouth) to the mouth; the Cache River Basin; and the Birds Point-New Madrid Floodway.

(h) Study suspended for indefinite period.

(230) MODEL STUDY FOR FLOOD CONTROL, CUMBERLAND, MARYLAND.

(b) The District Engineer, U. S. Engineer Office, Washington, D. C.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To study and develop proposed plans for the complete protection of Cumberland, Md., from floods.

(g) Cumberland, Md., is situated approximately 120 miles northwest of Washington, D. C., at the confluence of Wills Creek and the North Branch of the Potomac River. These two streams produce a severe flood problem in the vicinity of the confluence and along Wills Creek, the smaller of the two streams. The business district of Cumberland parallels Wills Creek closely and is subject to overflow from this stream. Channel improvement of Wills Creek by excavation and paving is under consideration, but the extent of such improvement is to some degree limited by the backwater of the North Branch of the Potomac River. This can be improved by downstream channel excavation and removal of some of the present obstructions. The model is of the fixed-bed type with an undistorted linear scale ratio of 1:60. Reproduced in the model are approximately 1.5 miles of Wills Creek, from its confluence with the North Branch of the Potomac River to above the city limits of Cumberland, Md., and 4 miles of the North Branch of the Potomac River (approximately 1 mile above and 3 miles below its confluence with Wills Creek).

(h) All authorized tests have been completed; future tests indefinite, depending on approval of prototype project report.

(231) MODEL STUDY OF NAVIGATION IMPROVEMENTS, GALOP RAPIDS SECTION, ST. LAWRENCE RIVER, NEW YORK.

(b) The District Engineer, U. S. Engineer Office, New York, N. Y.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for navigation improvements.

(f) (a) To determine the suitability of two alternate plans for obtaining a deep-water channel through Galop Rapids with particular reference to the provision of satisfactory velocities and alignments and freedom from navigation hazards; (b) to develop improvements in the proposed plans where necessary; and (c) to determine the optimum order of construction and the proper location of spoil areas.

(g) Some of the most complex hydraulic problems of the St. Lawrence River Navigation and Power Project are found in the Galop Rapids Section of the International Rapids Reach about 67 miles above Lake Ontario. The Galop Rapids form the control for water-surface elevations in Lake Ontario. Several alternate plans have been developed for the navigation project in this reach, some involving a dredged navigation channel through Galop Island, and others involving a dredged navigation channel past Galop Island, combined with a hydraulic regulation channel through the island. A specified maximum velocity must be provided in the navigation channel by the adopted plan, and Lake Ontario stages must not vary outside a certain range during construction or after completion of the project. A fixed-bed model with scales of 1:400 horizontally and 1:80 vertically is being used for this study. The limits of the model extend from Ogdensburg, N. Y., (mile 65 below Lake Ontario) to the vicinity of Sparrowhawk Point (mile 74.5 below Lake Ontario). The problem area is molded in removable blocks to facilitate the change from one plan to another.

(h) All tests have been completed; preparation of final report is in progress.

(232) (1147) MODEL STUDY FOR ELIMINATION OF SHOALING, VICINITY OF HEAD OF PASSES, MISSISSIPPI RIVER, LOUISIANA.

(b) The District Engineer, U. S. Engineer District, New Orleans, La.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for channel improvements.

(f) To study and develop plans for the improvement and maintenance of the deep-water channel from the Head of Passes to the Gulf of Mexico through Southwest Pass.

(g) The Mississippi River flows into the Gulf of Mexico through several natural outlets, of which only South and Southwest Passes are suitable for deep-water navigation. South Pass, the shorter of the two, offers a satisfactory, self-maintained navigation channel; the greatest difficulties of navigation by this route are found at the head and foot of the pass during high water. The entrance channel at the head of Southwest Pass, however, requires annual maintenance dredging. Tentative plans for the elimination of maintenance dredging in this pass were studied. The model was of the movable-bed type with scale ratios: horizontal dimensions, 1:500; vertical dimensions, 1:150. Reproduced were 7 miles of the Mississippi River above the Head of Passes, all of South and Southwest Passes, and the upper 2 miles of Pas a Loutre and of Cubits Gap. Cubits Gap and Pas a Loutre could be regulated to discharge any desired percentage of flow, while South and Southwest Passes were controlled by maintaining the water-surface elevation at mean Gulf level at their lower ends. These water-surface elevations were controlled by electrically-operated automatic valves which replaced tailgates in this model.

(h) All tests have been completed; preparation of final report is in progress.

(233) (793) MODEL STUDY OF CHANNEL IMPROVEMENTS, JOHNSTOWN, PENNSYLVANIA.

(b) The District Engineer, U. S. Engineer Office, Pittsburgh, Pa.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of channel improvements.

(f) To determine the most economical and effective design for the improvements of the channels of the Conemaugh River, Stony Creek, and the Little Conemaugh River, in the vicinity of Johnstown, Pa., so that floods of the magnitude of that of March 17-18, 1936, would be carried within banks.

(g) The project consists of the improvement of the channels of the Conemaugh River, Stony Creek, and the Little Conemaugh River, in the vicinity of Johnstown, Pa., for flood-control purposes. The project involves the widening, deepening, and realigning of the channels, and the construction of retaining walls where necessary to confine flood flows within the channels. The model was of the fixed-bed type with scale ratios: horizontal dimensions, 1:200; vertical dimensions, 1:80; and reproduced 5.8 miles of Stony Creek, 2.6 miles of the Little Conemaugh River, and 4.7 miles of the Conemaugh River, with sufficient overbank to include all areas considered in danger of possible flooding.

(h) All tests have been completed; preparation of final report has been suspended for an indefinite period.

(234) MODEL STUDY OF MEMPHIS HARBOR, MEMPHIS, TENNESSEE.

(b) The District Engineer, U. S. Engineer Office, Memphis, Tenn.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for general information.

(f) To determine the effects which the proposed closure of Tennessee Chute would have upon flood heights immediately after construction of the works and also after the configuration of the main channel has become adjusted to the new hydraulic conditions.

(g) Memphis Harbor comprises the upper 2 miles of Tennessee Chute, 2 miles of the Mississippi River upstream therefrom, and the lowermost 3 miles of Wolf River. Local interests desire improvement of Tennessee Chute to provide additional facilities for Memphis Harbor. The principal feature of the proposed improvement plan calls for the construction of a closure dam at the head of Tennessee Chute. The model is of the type which can be operated alternately as a fixed-bed or movable-bed model. Scale ratios are: horizontal dimensions, 1:600; vertical dimensions, 1:150. Reproduced in the model are 23.5 miles of the Mississippi River between Redman Point and Cow Island together with all overbank areas subject to overflow. Coal was selected as the model material to reproduce bed movement of the prototype channel.

(h) Design of the model is in progress.

(235) MODEL STUDY OF SECTIONS OF THE MIDDLE MISSISSIPPI RIVER.

(b) The District Engineer, U. S. Engineer Office, St. Louis, Mo.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for channel stabilization.

(f) To determine the effects of certain proposed plans for the maintenance of navigable depths in the low-water channel of the middle Mississippi River.

(g) Study of channel-stabilization plans for the middle Mississippi River. The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:2000; vertical dimensions, 1:100. Reproduced in the model are the main channel and overbank area of the Mississippi River from Grand Tower, Ill., (80 miles above Cairo, Ill.) to Cottonwood Point (134 miles below Cairo, Ill.); the Ohio River from Dam 50 (110 miles above Cairo, Ill.) to the mouth; the Cumberland River from the vicinity of Kuttawa, Ky., (42 miles above the mouth) to the mouth; the Tennessee River from the foot of Gilbertsville Dam (25 miles above the mouth) to the mouth; the Cache River Basin; and the Birds Point-New Madrid Floodway.

(h) Testing is in progress.

(236) MISSISSIPPI BASIN MODEL.

(b) Office, Chief of Engineers, U. S. Army, Washington, D. C.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for flood control improvements.

(f) To study coordination of operation problems at flood-control and multiple-purpose reservoirs, and to demonstrate by actual trial undesirable conditions which may arise from misdirected or uncoordinated operation.

(g) Construction and operation of a model of the Mississippi River watershed including the Ohio, Tennessee, Missouri, Arkansas, and Red Rivers and their principal tributaries. The model will be built to a horizontal scale of 1:2000, and a vertical scale of 1:100. All streams in the Mississippi River watershed on which reservoirs for flood control and multiple purposes are located or contemplated, and all existing and proposed flood-control reservoirs, together with all dams, levees, dikes, floodwalls, and other pertinent works will be reproduced. The model area will be approximately 200 acres, measuring 4500 ft east and west, and 3900 ft north and south. Water-surface elevations will be recorded at control points by 1500 electrical gages located over the model. Stream flow will be controlled by mechanical measuring equipment electrically operated from the same central control points.

(h) Design of the model is in progress.

(237) (415) MISSISSIPPI RIVER FLOOD-CONTROL MODEL.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for flood control improvements.

(f) To determine the effects of certain combinations of existing and proposed plans for controlling floods on the Lower Mississippi River.

(g) Study of flood-control plans for the Lower Mississippi River. The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:2000; vertical dimensions, 1:100. Reproduced in the model are the main channel of the Mississippi River from Helena, Ark., (300 miles below Cairo, Ill.) to Donaldsonville, La., (900 miles below Cairo, Ill.); the entire Atchafalaya Basin as far south as the Gulf of Mexico; and the backwater areas of the Arkansas, White, Yazoo, Ouachita, and Red Rivers.

(h) Testing has been temporarily suspended.

(238) MODEL STUDY OF FLOOD-CONTROL PLANS BELOW THE LATITUDE OF MORGAN CITY, LOUISIANA.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of flood-control project.

(f) To determine the most effective plan for flood protection in the latitude of Morgan City, La.

(g) Study of flood-control plans for the Lower Mississippi River and tributaries. The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:2000; vertical dimensions, 1:100. Reproduced in the model are the main channel of the Mississippi River from Helena, Ark., (300 miles below Cairo, Ill.) to Donaldsonville, La., (900 miles below Cairo, Ill.), the entire Atchafalaya Basin as far south as the Gulf of Mexico; and the backwater areas of the Arkansas, White, Yazoo, Ouachita, and Red Rivers.

(h) All tests have been completed; preparation of final report is in progress.

(239) MODEL STUDY OF HIGH-LEVEL CROSSINGS, MORGANZA AND WEST ATCHAFALAYA FLOODWAYS, LOUISIANA.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental,for design.

(f) To determine flow conditions through and below proposed trestles, the possibility of improvements in design, and the effects on stages upstream from the embankments.

(g) Tests are proposed for high-level crossings at three locations: the railroad and highway crossings of the West Atchafalaya Floodway at the Krotz Springs, La.; the railroad crossing between McKneely and Redcross, La.; and the railroad and highway crossings at Morganza, La. The investigation will entail the measurement of velocities as well as stages for constant flows of various magnitudes. The study will require the construction and operation of two models of the fixed-bed type, which will be built successively on the same site to horizontal scales of 1:600 and vertical scales of 1:50. The model of the West Atchafalaya Floodway will include the leveed floodway between latitudes 30°41'N and 30°26'N; that of the Morganza floodway will include the leveed floodway from its entrance (about latitude 30°50'N) to latitude 30°35'N.

(h) Design of the model is in progress.

(240) MODEL STUDY FOR THE INVESTIGATION OF VALLEY STORAGE CAPACITY, MISSISSIPPI RIVER.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for general information.

(f) To develop storage increment curves of various reaches of the Lower Mississippi River.

(g) This is a study of the valley storage capacity of the Lower Mississippi River. The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:2000; vertical dimensions, 1:100. Reproduced in the model are the main channel of the Mississippi River from Helena, Ark., (300 miles below Cairo, Ill.) to Donaldsonville, La., (900 miles below Cairo, Ill.); the entire Atchafalaya Basin as far south as the Gulf of Mexico; and the backwater areas of the Arkansas, White, Yazoo, Ouachita, and Red Rivers.

(h) Testing has been suspended for an indefinite period.

(241) MODEL STUDY OF FLOOD CONTROL PLANS, YAZOO BACKWATER AND HEADWATER AREAS.

(b) The District Engineer, U. S. Engineer Office, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of flood-control project.

(f) To determine the effect of Yazoo Backwater and Headwater Plans.

(g) Study of the flood-control plans for the Lower Mississippi River. The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:2000; vertical dimensions, 1:100. Reproduced in the model are the main channel of the Mississippi River from Helena, Ark., (300 miles below Cairo, Ill.)

to Donaldsonville, La., (900 miles below Cairo, Ill.); the entire Atchafalaya Basin as far south as the Gulf of Mexico; and the backwater areas of the Arkansas, White, Yazoo, Ouachita, and Red Rivers.

(h) All tests have been completed; preparation of the final report is in progress.

(242) MODEL STUDY OF WAVE AND SURGE ACTION, ANAHEIM BAY, CALIFORNIA.

(b) The Chief, Bureau of Yards and Docks, U. S. Navy Dept., Washington, D. C.; The District Engineer, U. S. Engineer Office, Los Angeles, Calif.; and the Long Beach Harbor Dept., City of Long Beach, Calif.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To determine the best location and alignment for the proposed extension of the San Pedro Bay detached breakwater system. Other aspects of the investigation concerned the determination of the relative effects of the alignment and location of the shore connecting elements of the breakwater system on the stability of Sunset Beach, and the characteristics of the current patterns within the breakwater enclosure relative to pollution in the enclosed harbor.

(g) Anaheim Bay in Orange County, Calif., is located between Seal Beach and Sunset Beach about seven miles downcoast from the Los Angeles River. The Anaheim Bay entrance lies downcoast from the present terminus of the San Pedro Bay detached breakwater system. To provide protection from wave and surge action for the Naval magazine and net Depot Harbor in Anaheim Bay, the Navy constructed converging jetties at the harbor entrance. The general plan involves the completion of the partially constructed east-west detached breakwater to, or near, the shore line some distance below Anaheim Bay. In conjunction with this general plan, the removal of the Navy jetties is contemplated. The model is of the fixed-bed type, except for Sunset Beach which is reproduced on a movable bed, with linear scale ratios of 1:300 horizontal, and 1:60 vertical. The model reproduces all of the San Pedro Bay coast line southward from a point about 8000 feet coastwise and northeast of the mouth of the San Gabriel River to Bolsa Bay, and the offshore hydrography of San Pedro Bay to about the 40 ft depth contour. The reproduced shore-line elements included Seal Beach, Anaheim Bay, and its harbor facilities and Sunset Beach. The model is equipped with adjustable wave machines for reproducing the prototype wave characteristics. Wave heights are measured and recorded by electrical devices. Sunset Beach is molded to recent survey contours and erosion and accretion is determined by soundings. Pollution characteristics are determined by plotting the paths of surface floats.

(h) All tests have been completed; preparation of the final report is in progress.

(243) MODEL STUDY OF SALT WATER INTRUSION, CALCASIEU RIVER, LOUISIANA.

(b) The District Engineer, U. S. Engineer Office, New Orleans, La.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for navigation improvements.

(f) To determine the effects of deepening the ship channel to 34 ft on the intrusion of salt water into the Calcasieu River and the passage of salt water eastward through the Intracoastal Waterway from the Calcasieu River to the Mermentau River Basin.

(g) The project provides for deepening the present Calcasieu River channel from Lake Charles, La., to the Gulf of Mexico from 30 ft to 34 ft. The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:1000; vertical dimensions, 1:50. All of the Calcasieu River and Lake, from the head of tide above Lake Charles to Calcasieu Pass in the Gulf of Mexico, is reproduced in the model, and approximately 10 miles of the Calcasieu River-Sabine River section and 10 miles of the Calcasieu River-Mermentau River section of the Gulf Intracoastal Waterway. The model is equipped with automatic tide controls in order to reproduce observed prototype tides in the Gulf of Mexico and in the east and west sections of the Intracoastal Waterway. Salt water of the correct density is introduced into the ocean water-supply system, and fresh water in the correct volume is introduced at the upper end of the model.

(h) All tests have been completed; preparation of final report is in progress.

(244) (1232) MODEL STUDY FOR ELIMINATION OF SHOALING, DEEPWATER POINT RANGE, DELAWARE RIVER, PENNSYLVANIA.

(b) The District Engineer, U. S. Engineer Office, Philadelphia, Pa.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for navigation improvement.

(f) To investigate plans proposed for reducing shoaling in Deepwater Point Range, Delaware River.

(g) The project provides for a channel about 96 miles long and of various specified dimensions extending from Philadelphia to deep water in Delaware Bay. Included in the project are the construction of dikes and training walls for regulation and control of tidal flow, and dredging to provide adequate anchorages at several points. Deepwater Point Range, a section of the main river channel, is located between Deepwater Point and Kilcohook disposal area. This channel shoals at an average annual rate of nearly 2,800,000 cu yd. The model, originally used for a study of the Chesapeake and Delaware Canal and revised for the Wilmington Harbor Study, is of the fixed-bed, silt-injection type with scale ratios: horizontal dimensions, 1:800; vertical dimensions, 1:80. Tides and currents are reproduced in the model by automatic tide gates.

(h) All tests have been completed; preparation of final report is in progress.

(Refer also to Project No. 245, "Model study for the elimination of shoaling in New Castle and Finns Point Ranges, Delaware River, Pennsylvania".)

(245) (1232) MODEL STUDY FOR THE ELIMINATION OF SHOALING IN NEW CASTLE AND FINNS POINT RANGES, DELAWARE RIVER, PENNSYLVANIA.

(b) The District Engineer, U. S. Engineer Office, Philadelphia, Pa.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for channel improvement.

(f) To test plans proposed for reducing shoaling in New Castle and Finns Point Ranges, Delaware River.

(g) The project provides for a channel about 96 miles long and of various specified dimensions extending from Philadelphia to deep water in Delaware Bay. Included in the project are the construction of dikes and training walls for regulation and control of tidal flow, and dredging to provide adequate anchorages at several points. New Castle and Finns Point Ranges (sections of the main river channel) are located between Kilcohook disposal area and the Chesapeake and Delaware Canal entrance. The ranges together shoal at an average annual rate of 2,000,000 cu yd. The Chesapeake and Delaware Model as revised for the Wilmington Harbor study is being used for the tests. The model is of the fixed-bed, silt-injection type with scale ratios: horizontal dimensions, 1:800; vertical dimensions, 1:80. Tides and currents are reproduced in the model by automatic tide gates.

(h) All tests have been completed; preparation of final report is in progress.

(Refer also to Project No. 244, "Model study for elimination of shoaling, Deepwater Point Range, Delaware Bay, Pennsylvania".)

(246) MODEL STUDY OF LYNNHAVEN BAY, VIRGINIA.

(b) The District Engineer, U. S. Engineer Office, Norfolk, Va.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for navigation improvements.

(f) To develop the most efficient design of inlet and interior channels to provide the desired volume of tidal flow into and out of Lynnhaven Bay.

(g) The project consists of plans for the development and maintenance of inlet and interior channels through the shoals that now retard tidal flow through the inlet and into the waters of the bays tributary to the inlet, and for the development of jetties to prevent reshoaling of the inlet channels. The model will be of the fixed-bed type, reproducing all of Lynnhaven Bay and Inlet and a portion of Chesapeake Bay adjacent to the inlet sufficiently large for accurate reproduction of observed prototype tides and currents. Scale ratios: horizontal dimensions, 1:800; vertical dimensions, 1:80.

Provisions will be made for reproducing prototype tides and tidal currents to scale throughout the model, and for varying the widths and depths of the inlet and interior channels to determine the optimum channel cross-sections required to provide the desired tidal flow into and out of Lynnhaven Bay.

(h) Design of the model is in progress.

(247) MODEL STUDY OF ENTRANCE CHANNEL CURRENTS, MIDWAY ISLANDS.

(b) The Chief, Bureau of Yards and Docks, U. S. Navy Department, Washington, D.C.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To determine the best plan for reduction of the entrance channel currents. These entrance channel currents are caused by the rising of the lagoon waters above the surrounding ocean area. This phenomenon is caused by wave action coupled with the peculiar physical features of the atoll.

(g) The small atoll, known as Midway Islands, is located about 1300 statute miles northwest of Honolulu, Territory of Hawaii. This atoll has been developed as a naval operating base with harbor facilities for submarines, tankers, and cruisers. An entrance channel on the south side of the atoll leads from the Pacific Ocean into the submarine basin and lagoon mooring area. Wave action raises the level of the lagoon sometimes as much as 2 feet above the surrounding ocean area which is accompanied by very strong currents in the entrance channel. The currents coupled with the action of wind and waves make navigation conditions very difficult in the entrance channel, especially at the channel mouth. The improvement plans proposed various schemes such as widening the channel mouth, widening the channel from 400 to 1000 feet, in 200 feet increments, in combination with various lengths of breakwaters on the west side of the channel, and enclosing the deep water area of the central lagoon by an impervious breakwater. The model was of the fixed-bed type with linear scale ratios of 1:500 horizontal and 1:100 vertical. The model reproduced the entire atoll and the Pacific Ocean to about the 120 ft depth contour. The model was equipped with adjustable wave machines for reproducing to scale the prototype wave characteristics. A circulating system attached to the model supplied the proper amount of water to maintain a constant ocean level at the channel mouth. The current magnitudes were measured with floats and a miniature current meter. Wave heights were measured and recorded by electrical devices.

(h) All tests have been completed; preparation of the final report is in progress.

(248) MODEL STUDY OF LYNNHAVEN INLET, VIRGINIA.

(b) The District Engineer, U. S. Engineer Office, Norfolk, Va.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for navigation improvements.

(f) To determine the effectiveness of jetties in preventing reshoaling of the inlet channel as developed from tests on the Lynnhaven Bay fixed-bed model, and to determine the effects of jetties on the beaches adjacent to the inlet.

(g) The project consists of plans for the development and maintenance of inlet and interior channels through the shoals that now retard tidal flow through the inlet and into the waters of the bays tributary to the inlet, and for the development of jetties to prevent reshoaling of the inlet channel. The model will be of the movable-bed type, reproducing Lynnhaven Inlet and adjacent beaches for a distance of about 10,000 ft to the east and west of the inlet, and off-shore areas to about the minus 25 ft contour of depth in Chesapeake Bay. Scale ratios will be: horizontal dimensions, 1:400; vertical dimensions, 1:80. Provisions will be made for reproducing waves from any direction between northeast and northwest and tides of any type. The littoral and tidal currents that flow along the southern shore line of Chesapeake Bay in the vicinity of Lynnhaven Inlet will also be simulated in the model.

(h) Model is under construction.

(249) MODEL STUDY OF WAVE AND SURGE ACTION, MONTEREY HARBOR, CALIFORNIA.

(b) The District Engineer, U. S. Engineer Office, San Francisco, Calif.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for the design of harbor improvements.

(f) To determine (a) the locations for a proposed companion breakwater and project-breakwater extension which will afford maximum protection for anchorage while not subjecting the harbor to pollution; (b) the best method of reducing the effects of surge action and deposition adjacent to Municipal Wharf No. 1; and (c) the effects of installing an amphibious training base.

(g) Proposed improvements for Monterey Harbor, Calif., comprise (a) lengthening of the existing breakwater by 2000 ft, and construction of a 1500-ft long companion breakwater extending from shore in such a way as to form an enclosed harbor with a navigation entrance; (b) dredging adjacent to Municipal Wharf No. 1; and (c) installation of an amphibious training base for Sixth Army. The model is of the fixed-bed type, with a linear scale ratio of 1:100, model to prototype. Its limits include all of Monterey Harbor and a sufficient area of Monterey Bay to the northwest, north, and east to permit reproduction of wave action from critical directions. Wave action is simulated by specially designed wave machines precisely calibrated to attain the requisite time and elevation ranges for the study. Amplitude and frequence results are measured throughout the problem area by oscillographs which record the impulses resulting from wave action on electrical wave-measuring rods systematically located at specific stations. The model covers 6000 sq ft representing a prototype area of 2.34 square miles.

(h) Testing is in progress.

(250) MODEL STUDY OF SALINITY INTRUSION, NEW YORK BAY-DELAWARE RIVER SECTION OF THE INTRACOASTAL WATERWAY.

(b) The District Engineer, U. S. Engineer Office, New York, N. Y.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental for general information.

(f) To determine the quantity of fresh water required for operation of the Sayreville locks, including flushing and scavenging water; and to develop the most effective location and design of the salt-water sumps and drains.

(g) The proposed New Jersey Ship Canal would extend a distance of about 34 miles across the State of New Jersey from Sayreville, N. Y., on Raritan Bay (the most westerly arm of New York Bay) to the Delaware River at Bordentown, N. J. In order to prevent intrusion of salt water from Raritan Bay in the upper reaches of the canal and the Delaware River, it is proposed to maintain an upper-pool elevation of 10 ft above mean low water (at Sayreville) by means of locks and dams at both ends of the canal, the Sayreville end to be so designed as to be kept salt-free by flushing and scavenging. The canal would be navigable by vessels of 25-ft draft with the upper pool drawn down to 5 ft above mean low water. Two models were involved in this study: (a) a 1:60-scale model reproducing the locks with a small portion of the lower and upper pools and with the salt-water sump and drains. The Ship and Barge locks were built with all appurtenances for filling and flushing; (b) a 1:150-scale comprehensive model of the fixed-bed type reproducing all of the upper pool and 11 miles of the canal in which scavenging of salt water from the artificial lake (upper pool), as well as encroachment of salt water into the canal, was studied.

(h) All tests have been completed.

(251) (1233) MODEL STUDY OF SAVANNAH RIVER HARBOR, GEORGIA.

(b) The District Engineer, U. S. Engineer Office, Savannah, Ga.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for harbor improvements.

(f) To study means of improving and maintaining the ship channel from Savannah, Ga., to deep water in the Atlantic Ocean, consideration being given to the effect of proposed improvements on adjacent recreation beaches.

(g) The project for the improvement of Savannah Harbor includes the revision of

existing jetties at the mouth of the Savannah River, the relocation of the inland waterway through the harbor, and the enlargement of the ship channel at various points. The model was of the fixed-bed type with scale ratios: horizontal dimensions, 1:1000; vertical dimensions, 1:150. Reproduced in the model were the Savannah River from the head of tidewater to the mouth, and all areas in the vicinity of the mouth which are subject to tidal flow. Two automatic tide controls were used for tidal reproduction. Salt water of the correct specific gravity was introduced through the ocean supply valve, and was colored with potassium permanganate to permit visual observation of salinity currents.

(h) All tests have been completed; preparation of final report is in progress.

(252) PILOT MODEL STUDY OF SOUTHWEST PASS, MISSISSIPPI RIVER, LOUISIANA.

(b) The Division Engineer, Lower Mississippi Valley Division, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for model design.

(f) (a) To develop special model appurtenances and operating technique required to reproduce prototype density currents in Southwest Pass by the simultaneous removal of salt water and introduction of fresh water at the upstream end of the model; and (b) to select a movable-bed material that will move at the same rate (to scale) as that of the prototype without serious exaggeration of the model discharge and velocity scales. These data and model appurtenances will be used for a later comprehensive model study of Southwest Pass.

(g) The project for Southwest Pass provides for development of plans for elimination or reduction of shoaling in the Southwest Pass Bar Channel. The model will be of the movable-bed type, and will include Southwest Pass from mile 5 below the Head of Passes to the ends of the jetties, and a 2.25 sq mi area of the Gulf of Mexico adjacent to the jetties. Scale ratios will be: horizontal dimensions, 1:500; vertical dimensions, 1:100. Provisions will be made for reproducing prototype tides and tidal currents in the simulated Gulf of Mexico, density flow and fresh-water river flow in Southwest Pass, and the movement of bed-load material in lower Southwest Pass and the bar channel. The model will be so designed and constructed that it can be enlarged for the later comprehensive study of Southwest Pass at minimum cost and time.

(h) Design of the model is in progress.

(253) MODEL STUDY FOR CHANNEL IMPROVEMENT, ST. JOHNS RIVER, FLORIDA.

(b) The District Engineer, U. S. Engineer Office, Jacksonville, Fla.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for navigation improvements.

(f) To determine the best location and alignment of the cut-off and the effect on navigation of the cut-off and the deepening of the present channel to 34 ft.

(g) The project provides for a cut-off in the St. Johns River below Jacksonville, Fla., which will extend from Dames Point to Fulton in connection with deepening of the present channel from Jacksonville to the Atlantic Ocean to a depth of 34 ft. The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:1000; vertical dimensions, 1:100. The model includes the St. Johns River from Welaka, Fla., to the Atlantic Ocean, as well as approximately six miles of the Intracoastal Waterway to the north and south of the St. Johns River. The model is equipped with automatic tide controls in order to reproduce the observed prototype tides in the St. Johns River and in the north and south sections of the Intracoastal Waterway. Salt water of the correct density is introduced into the ocean water-supply system, and fresh water is introduced at the upper end of the model.

(h) All tests have been completed; preparation of final report is in progress.

(254) MODEL STUDY OF POLLUTION, ST. JOHNS RIVER, FLORIDA.

(b) The City of Jacksonville, Florida.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for information.

(f) To devise a system of training walls which would prevent pollution by raw sewage along the west bank of the St. Johns River between the mouth of Ortega River and Winter Point.

(g) The study was conducted on the St. Johns River model previously used for a study of navigation improvement of St. Johns River. (See Project No. 253, "Model study of channel improvement, St. Johns River".) The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:1000; vertical dimensions, 1:100. The model includes the St. Johns River from Welaka, Fla., to the Atlantic Ocean, as well as approximately six miles of the Intracoastal Waterway to the north and south of the St. Johns River. The model is equipped with automatic tide controls in order to reproduce the observed prototype tides in the St. Johns River and in the north and south sections of the Intracoastal Waterway. Salt water of the correct density is introduced into the ocean water supply system, and fresh water is introduced at the upper end of the model.

(h) All tests have been completed; preparation of a final report is in progress.

(255) MODEL STUDY OF SHOALING IN THE BAR CHANNEL, UMPQUA RIVER, OREGON.

(b) The District Engineer, U. S. Engineer Office, Portland, Ore.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for navigation improvements.

(f) To determine whether or not the relocation or improvement of the South Jetty will effect an appreciable decrease in the present heavy rate of shoaling in the entrance channel.

(g) The project for the improvement of Umpqua River consists of plans for the relocation or improvement of the South Jetty and maintenance of an entrance channel 26 ft deep and of suitable width. The model is of the movable-bed type, the movable-bed reach extending 10,000 ft north of and 10,000 ft south of the mouth of the Umpqua River and offshore to about the 80-ft contour of depth in the ocean. The river is reproduced from the mouth to a point above Winchester Bay. Scale ratios: horizontal dimensions, 1:400; vertical dimensions, 1:80. Provisions are made for reproducing waves from any direction from northwest to southwest, tides of any type, and littoral currents either up or down the coast.

(h) Testing is in progress.

(256) (969) MODEL STUDY OF WAVE FORCE AGAINST BREAKWATERS.

(b) The Division Engineer, Great Lakes Division, Chicago, Ill.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of harbor improvements.

(f) To develop vertical pressure curves (showing the pressures resulting from waves striking against breakwaters) to be used as a basis for the design of breakwaters. Four variables will be investigated and the resulting vertical pressure curves developed. These variables are (a) heights and lengths of waves; (b) depth of water and slope of bottom; (c) shape of breakwaters; and (d) angle of impingement of waves.

(g) In designing breakwaters it is often necessary to know the magnitude of the wave force exerted thereon. This has been computed theoretically or measured at single points by dynamometers, but neither method is considered satisfactory. This project provides for the determination by model tests of the form of the vertical pressure curve, and of the relation between pressure ordinates and wave heights. The investigation is conducted in a 5-ft by 18-ft by 117-ft concrete tank equipped with a 4-ft by 8-ft viewing window in the tank's side at the breakwater. A plunger-type wave machine capable of producing a 1-ft wave is used. Wave pressure is measured by a bank of specially developed pressure cells and recorded, simultaneously with wave heights, on a seven-element oscillograph. Wave heights are determined by means of an electric wave-height measuring device developed at the Experiment Station.

(h) Study suspended for indefinite period.

(257) MODEL STUDY OF STABILITY OF RUBBLE-MOUND BREAKWATERS.

(b) The Chief, Bureau of Yards and Docks, U. S. Navy Dept., Washington, D. C.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) The primary purpose of the model study is to determine the most efficient design of a composite rubble-mound breakwater, and to determine the effect of the dynamic forces of wave action on the breakwater during different phases of construction.

(g) The rubble-mound breakwater stability study is being conducted in a 5-ft by 18-ft by 117-ft concrete tank equipped with a plunger-type wave machine. The wave heights and lengths are measured by electrical measuring devices. A hypothetical prototype breakwater is reproduced in the model using scale ratios of 1:30, 1:45, and 1:60. The rubble-mound breakwater structure consists of three types of materials: class-C fine core material, class-B enrockment for the class-C material, and class-A rock used to form the cap of the breakwater. Each class of material makes up a section of the breakwater structure which is subjected to storm waves of 15 ft by 270 ft and 21 ft by 300 ft until stabilization of the breakwater section is reached. The model breakwater reproduces to scale (linear, weight, and volume) the prototype breakwater designs and specifications.

(h) Testing is in progress.

(258) MODEL STUDY OF WAVE AND SURGE ACTION, NAVAL OPERATING BASE, TERMINAL ISLAND, SAN PEDRO, CALIFORNIA.

(b) The Chief, Bureau of Yards and Docks, U. S. Navy Dept., Washington, D. C.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To determine the best plan for protecting the Navy piers and drydocks at the Naval Operating Base, Terminal Island, San Pedro, Calif., from the effects of wave and surge action.

(g) The above-mentioned Navy piers and drydocks are located along an east-west marginal wall on the southern shore line of Terminal Island. Terminal Island is located about half way between the cities of San Pedro and Long Beach, Calif. Terminal Island and most of San Pedro Bay is protected, to a certain extent, by an outer breakwater system about 6.5 miles in length. However, at times this outer breakwater system allows a sufficient amount of wave energy to reach the pier area to cause troublesome conditions for moored ships. The improvement plan consisted of the construction of a mole which would surround the Navy piers and drydocks. This plan was devised to provide protection to the existing facilities and to provide an enlarged operating base. The model was of the fixed-bed type with linear scale ratios of 1:300 horizontal, and 1:60 vertical. The model reproduced all of the coast line from Pt. Femin to Anaheim Bay, Calif., the Los Angeles river and outer harbors, Long Beach river and outer harbors, all of San Pedro Bay, the San Pedro breakwater, the detached breakwater and a large area of the Pacific Ocean south of the detached breakwater. The model was equipped with adjustable wave machines for reproducing to scale the prototype wave characteristics. Wave heights are measured and recorded by electrical devices.

(h) All tests have been completed; preparation of the final report is in progress.

(259) MODEL STUDY OF BREAKWATER LOCATION, U. S. NAVAL AIR STATION, ALAMEDA, CALIFORNIA.

(b) The Chief, Bureau of Yards and Docks, U. S. Navy Dept., Washington, D. C.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To determine the best plan for reducing wave action at the carrier pier and in the seaplane lagoon, and for reducing shoaling in the dredged turning basin at the U. S. Naval Air Station, Alameda, Calif.

(g) The U. S. Naval Air Station, Alameda, Calif., has facilities for both land and sea-type aircraft and naval ships of various types. These installations are located west of Alameda, Calif., along a section of exposed shore line

of San Francisco Bay. The location of the Naval Air Station is such that the docking facilities are exposed to local storm waves and the dredged turning basin is shoaled considerably by the deposition of silt transported in suspension by the ebb-tide currents from mud flats southeast of the turning basin. The proposed plans of improvement consisted of several breakwater plans so located as to follow the general alignment of the south line of the turning basin and entrance channel. The model was of the fixed-bed type with linear scale ratios of 1:200, horizontal and vertical. The model reproduced the shore line adjacent to the prototype, the seaplane lagoon, the carrier pier, the entrance channel and turning basin, and a part of the adjoining area of San Francisco Bay. The model was equipped with adjustable wave machines for reproducing the prototype wave characteristics. A circulating system attached to the model reproduced prototype ebb-tide currents. Gilsonite was used for silt material and this material was introduced into the model through a system which consisted of a mixing tank, pipe lines, and perforated troughs. Wave heights were measured and recorded by electrical devices. The depths of model silt deposits were measured by sounding and the volumes of silt determined by graphical methods.

(h) All tests have been completed; preparation of the final report is in progress.

U. S. DEPT. OF AGRICULTURE, FOREST SERVICE, California Forest and Range Experiment Station, Berkeley, Calif.

Inquiries concerning Project Nos. 261 to 265, incl., should be addressed to Mr. S. N. Wyckoff, Director, or Mr. C. J. Kraebel, in charge Division of Forest Influences, California Forest and Range Experiment Station, Berkeley, Calif.

(260) (1303) EFFECT OF BEDLOAD AND CHANNEL SLOPE ON RATING OF SAN DIMAS METERING FLUME.

(b) California Forest and Range Experiment Station, Forest Service, U. S. Dept. of Agriculture, and other agencies, measuring loaded stream flow and flow in steep channels.

(d) S. N. Wyckoff, Director, California Forest and Range Experiment Station, Berkeley, Calif.; or Prof. M. P. O'Brien, University of California, Berkeley 4, Calif.

(e) Laboratory project in cooperation with the University of California.

(f) Calibration of the San Dimas metering flume under various conditions of bedload and channel slopes.

(g) Laboratory experiments on models.

(h) Equipment installed, but project now inactive.

(261) (1305) WATERSHED MANAGEMENT (Southern California).

(b) California Forest and Range Experiment Station, Forest Service, U. S. Dept. of Agriculture, and other agencies responsible for the management of watersheds and production of water supplies.

(c) J. D. Sinclair, P. B. Rowe, H. C. Storey, E. L. Hamilton, J. S. Horton, E. A. Colman.

(e) Comprehensive investigation of hydrology, erosion, and related studies in mountainous watersheds of California, including laboratory studies at selected field stations and at Berkeley headquarters.

(f) (1) To study the disposition of rainfall as influenced by watershed conditions including topography, geology, soils, and vegetation; and (2) to develop methods of watershed management which will assure both the maximum yield of usable water and satisfactory regulation of flood runoff and erosion.

(g) Major work center is the San Dimas Experimental Forest, a 17,000-acre area on the south slopes of the San Gabriel mountains comprising Big Dalton and San Dimas Canyons. More than 400 rain-gages have been installed to measure rainfall. Ten large and seven small watersheds within the two drainages are equipped with gaging stations to measure streamflow. The seven small watersheds also have reservoirs to measure erosion. The Big Dalton and San Dimas

reservoirs of the Los Angeles County Flood Control District provide measurements of runoff and erosion from the two main drainages. More intensive measurements of surface runoff and erosion are obtained from eighteen small plots. A series of twenty-six large lysimeters is designed to compare the use of water by the more important species of shrubs and one species of pine. Essential climatic data have been obtained from several meteorological stations within the Experimental Forest.

(h) Collection of records was begun upon completion of each research installation, principally during the period 1933 to 1937, and continued on the entire Experimental Forest until October 1, 1946. The loss of emergency assistance last year made it necessary to suspend about eighty percent of the hydrologic records. Activities now in progress include:

(1) The continuation of precipitation and streamflow measurements from two large watersheds, and erosion records from seven small watersheds. The series of large lysimeters and essential climatic measurements are also being maintained. (2) Special rainfall studies including rain-gage placement in relation to topography, the use of shields, the study of storm components and comparative intensity measurements within the watersheds referred to above. (3) The development of a direct reading electrical soil moisture meter. (4) The analysis of accumulated data and preparation of reports for publication.

(i) "Water for the year 2000." Stuart O. Blythe. California Magazine of Pacific Business, Vol. 26, No. 11: 20-23, 51-52. November 1936.

"Fighting fire and flood with science." Union Oil Bulletin, Vol. 19, No. 8: 14-19. August 1938.

"Measurement of debris-laden streamflow with critical-depth flumes." H. G. Wilm, John S. Cotton, and H. C. Storey. Trans. A.S.C.E., Vol. 103, No. 9: 1237-1278. September 1938.

"The forest floor of the chaparral in San Gabriel Mountains, California." Joseph Kittredge, Jr. Jour. Agri. Res., Vol. 58, No. 7: 521-535. April 1939.

"The annual accumulation and creep of litter and other surface materials in the chaparral of the San Gabriel Mountains, California." Joseph Kittredge,Jr. Jour. Agri. Res., Vol. 58, No. 7: 537-541. April 1939.

"An analysis of precipitation measurements on mountain watersheds." H. G. Wilm, A. Z. Nelson, and H. C. Storey. Monthly Weather Review, Vol. 67: 163-172. June 1939.

"The San Dimas Experimental Forest." C. J. Kraebel and J. D. Sinclair. Trans. American Geophysical Union, Pt. I: 84-92. 1940.

"The San Dimas Experimental Forest." E. L. Hamilton. Social Studies Review, Vol. 16, No. 5: 10, 12-14. October 1940.

"Topographic influences on precipitation." H. C. Storey. Proc. Sixth Pacific Science Congress at Berkeley, Calif., 1939. Soil Resources, Vol.4: 985-993. July 1941.

"The sample plot as a method of quantitative analysis of chaparral vegetation in Southern California." Jerome S. Horton. Ecology, Vol. 22, No. 4: 457-468. October 1941.

"A comparative study of rain gages." H. C. Storey and E. L. Hamilton. Trans. American Geophysical Union, Pt. I: 133-141. 1943.

"A system for the synchronization of hydrologic records." E. L. Hamilton. Trans. American Geophysical Union, Pt. II: 624-631. 1943.

"A Nomograph for the integration of stream flow records." Paul B. Johnson. Civil Engineering, Vol. 13, No. 10: 494-495. October 1943.

"Rainfall measurement as influenced by storm characteristics in Southern California mountains." E. L. Hamilton. Trans. American Geophysical Union, Pt. III: 502-518. 1944.

"A comparison of vertical and tilted rain gages in estimating precipitation on mountain watersheds." H. C. Storey and H. G. Wilm. Trans. American Geophysical Union, Pt. IV: 518-523. 1944.

"The San Dimas waterstage transmitter." E. A. Colman and E. L. Hamilton. Civil Engineering, Vol. 14, No. 6: 257-258. June 1944.

"The wood rat as an ecological factor in Southern California watersheds." Jerome S. Horton and John T. Wright. Ecology, Vol. 25, No. 3: 341-351. July 1944.

"The dependence of field capacity upon the depth of wetting of field soils." E. A. Colman. Soil Science, Vol. 58, No. 1: 43-50. July 1944.

"Velocity-head rod calibrated for measuring stream flow." H. G. Wilm and H. C. Storey. Civ. Eng., Vol. 14, No. 11: 475-476. November 1944.

"Some quantitative relations of foliage in the chaparral." Joseph Kittredge, Jr. Ecology, Vol. 26, No. 1: 70-73. January 1945.

"Some improvements in tensiometer design." E. A. Colman, W. B. Hanawalt, and C. R. Burck. Jour. Amer. Soc. Agron., Vol. 38, No. 5: 455-458. May 1946.

"A laboratory study of lysimeter drainage under controlled soil moisture tension." E. A. Colman. Soil Science, Vol. 62, No. 5. November 1946.

"The place of electrical soil moisture meters in hydrologic research." E. A. Colman. Trans. American Geophysical Union, Vol. 27, No. VI: 847-853. December 1946.

"Hydrologic aspects of burning brush and woodland-grass ranges in California." Frank Adams, Paul A. Ewing, and Martin R. Huberty. California State Board of Forestry, 41-46. January 1947.

"The San Dimas Rain Gage Mechanism." E. L. Hamilton. (In print.) Bull. Amer. Met. Soc. 1947.

Report of the Committee on Transpiration and Evaporation, Trans. American Geophysical Union: Part II: 401-402. 1943.

Part V: 683-684. April 1945.

Vol. 26, No. III: 451-452. December 1945.

Vol. 27, No. V: 720-721. October 1946.

(262) (1306) WATERSHED MANAGEMENT (Sierra Nevada).

(b) California Forest and Range Experiment Station, Forest Service, U. S. Dept. of Agriculture, and other agencies responsible for the management of watersheds and production of water supplies.

(e) Comprehensive investigation of hydrology, erosion, and related studies in mountainous watersheds of California, including laboratory studies of selected field stations and at Berkeley headquarters.

(f) Investigation of the influence of precipitation, physiography, vegetative cover and watershed denudation or other treatment upon total water yield and rates of runoff and erosion.

(g) Hydrologic measurements in watersheds of various sizes from 0.01 to 0.86 square miles, under normally vegetated conditions, denuded by fire, treated by grazing, logging, or otherwise; and studies of meteorological factors, vegetation, soils, and geology of the watershed areas. Major work center is Kings River Branch Station within the Kings River drainage of the southern Sierra Nevada. Studies have been carried on at two type localities, namely, Big Creek and Teakettle Creek. The Big Creek area ranges in elevation from 1000 to 2500 feet and comprises seven small watersheds, 20 to 36 acres in area, in the foothill woodland-grass type. The Teakettle Creek area ranges in elevation from 6000 to 8000 feet and comprises three 500-acre watersheds in the conifer forest type with precipitation largely in the form of snow. Research installations include 4 climatic stations, 100 rain gages, 15 snow courses, and 12 stream gaging and erosion measuring stations.

(h) Collection of records was begun upon completion of each research installation, starting in 1936, and office reports prepared summarizing seasonal measurements. It became necessary, due to the lack of assistance, to suspend the collection of data from the Teakettle Creek area in 1942 and the Big Creek area in 1946.

(i) "Kings River Branch Watershed study units." S. M. Munson. California Forest and Range Experiment Station Technical Note No. 11. 1938.

(263) (1307) INFLUENCE OF FOREST VEGETATION ON STREAMFLOW AND SOIL EROSION.

(b) California Forest and Range Experiment Station, Forest Service, U. S. Dept. of Agriculture.

(c) P. B. Rowe and assistants.

(e) Extensive laboratory and field experiments of the influences of forest vegetation on the disposition of precipitation as they affect water yield, surface run-off, and erosion.

(f) Investigations of the role of the coast chaparral and other vegetation, including mustard cover and various types of forest litter, in the management of watersheds for flood and erosion control and the production of usable water.

(g) Three series of lysimeters and three pairs of runoff and erosion plots supplemented by climatological installations were used to determine effects of litter and vegetation, soil type, and slope on surface runoff, infiltration, evaporation, and erosion.

(h) Project discontinued. Analysis of data pending.

(264) (1308) INFLUENCE OF FOREST VEGETATION ON STREAMFLOW AND SOIL EROSION.

(b) California Forest and Range Experiment Station, Forest Service, U. S. Dept. of Agriculture.

(c) P. B. Rowe, H. W. Anderson, E. A. Colman, and assistants.

(e) Intensive field experiments of influences of forest vegetation on the disposition of precipitation as they affect water yield, surface runoff, and erosion.

(f) Investigations of the role of forest, woodland, and chaparral cover in the management of watersheds for flood and erosion control and the production of usable water.

(g) Experimental installations include: (1) At North Fork, California - Sierra Nevada foothill woodland chaparral type: 3 pairs of 1/40-acre surface runoff and erosion plots established 1929; 2 pairs of 1/100-acre surface runoff and erosion plots established 1933 and equipped for obtaining data from natural and artificially applied rainfall; three 1/20-acre soil moisture sampling plots; 8 lysimeters; 2 streamflow-interception units; 3 soil temperature pits; 6 snow stations; 1 weather station, and various meteorological equipment; automatic precipitation and runoff recording devices. (2) At Bass Lake, California - Sierra Nevada second-growth ponderosa pine type: 2 triplicate sets of 1/40-acre surface runoff and erosion plots established in 1934; three 1/20-acre soil moisture sampling areas; 1 streamflow-interception unit; 5 snow courses; 1 standard weather station, and various meteorological equipment; automatic precipitation and runoff recording devices.

(h) Collection of records suspended in May 1946. Tabulation and analysis of data in progress.

(i) "Some factors of the hydrology of the Sierra Nevada foothills." P. B. Rowe. Trans. American Geophysical Union, Pt. I: 90-100. 1941.

Discussion of paper by Veihmeyer and Johnston entitled, "Soil moisture records from burned and unburned plots in certain grazing areas of California". P. B. Rowe. Trans. American Geophysical Union, Pt. I: 84-86. 1944.

"The effect of freezing on soil moisture and on evaporation from a bare soil." Henry W. Anderson. Trans. American Geophysical Union, Vol. 27, No. 6: 863-870. 1946.

"Soil freezing and thawing as related to some vegetation, climatic and soil variables." Henry W. Anderson. Journal of Forestry, Vol. 45, No. 2: 94-101. 1947.

"Hydrologic aspects of burning brush and woodland-grass ranges in California." Frank Adams, Paul A. Ewing, and Martin R. Huberty. State of California Division of Forestry: 49-55. 1947.

"Some influences of woodland-chaparral vegetation on soil-water relations." P. B. Rowe. Manuscript.

(265) (1309) INFLUENCE OF FOREST VEGETATION AND LAND USE ON STREAMFLOW AND SOIL EROSION.

(b) California Forest and Range Experiment Station, Forest Service, U. S. Dept. of Agriculture.

(c) P. B. Rowe and assistants.

(e) Intensive field studies of the influences of various physiographic, climatic, and biotic factors as they affect the infiltration capacity of soils.

(f) (1) To test and perfect infiltrometer equipment for field sampling; (2) to determine the influence of such factors as soil type, vegetation cover, land use, and intensity and duration of rainfall on the infiltration capacity of soils; and (3) to develop methods of applying infiltration data in watershed hydrologic analyses.

(g) The North Fork portable small plot infiltrometer, employing both the North Fork and F. A. types of rainfall applicators and similar equipment, tested and used in field infiltration studies. Studies of the relations between the environmental factors, including land use, and the infiltration capacities of soils as they affect runoff, water yield, and erosion have been conducted on several watersheds in California. Some of the field work was done by the U. S. Dept. of Agriculture, Flood Control Surveys.

(h) Project inactive at present.

(i) "An infiltration study of a denuded and a forest covered soil." P. B. Rowe, D. M. Ilch, and Rene Bollaert. California Forest and Range Experiment Station Research Note No. 14, mimeograph. 1937.

"The construction, operation, and use of the North Fork infiltrometer." P. B. Rowe. U. S. Dept. of Agriculture, Flood Control Coordinating Comm. Misc. Pub. No. 1. 1940.

"A method of hydrologic analysis in watershed management." P. B. Rowe. Trans. American Geophysical Union, Pt. II: 632-649. 1943.

"Discussion of 'Role of the land during flood periods', by W. W. Horner." P. B. Rowe, Proc. A.S.C.E., Vol. 69, No. 10: 1616-1618. December 1943.

ECOLE POLYTECHNIQUE DE MONTREAL, Hydraulics Laboratory, 1430 Rue Saint-Denis, Montreal 18, Canada.

Inquiries concerning Project No. 266 to 268, incl., should be addressed to Prof. Raymond Boucher, Ecole Polytechnique, 1430 Saint-Denis Street, Montreal 18, Canada.

(266) (639) HYDRAULIC MODEL STUDIES OF DIFFERENT SPILLWAY PROFILES.

(b) Laboratory project. (c) Prof. R. Boucher and assistants.

(e) General experimental research.

(f) To establish a comparison between the discharge capacities of different spillway designs.

(g) Studies are made on concrete models of existing and recommended spillway profiles. Pressure distribution on spillway faces and coefficients of discharge are determined for various heads up to the design head. The effect of gate piers of various designs is also investigated.

(h) Seven different profiles have been studied, including two modifications of Creager-Justin profile upstream of crest line. The experimental work has been proceeding very irregularly in the last two years and will be resumed during 1947.

(267) MODEL TESTS OF A LOG FLUME CONTROL SECTION.

(b) The Shawinigan Engineering Company, Ltd., Montreal.

(c) Prof. R. Boucher and assistants.

(e) Experimental project for design information.

(f) To determine the efficiency of a control section for open channels consisting of a laterally tapering section of channel with bottom sloping in the direction of flow.

(g) The model to a scale of 1:7.5 was installed in the 30-inch glass-sided flume, preceded by a short length of rectangular channel. Tests were made for heads up to the designed head to determine discharge coefficients. Profiles of the nappe were also obtained to complete observation of flow conditions.

(h) Tests partly completed and test results submitted to the Shawinigan Engineering Company.

(268) CALIBRATION TESTS OF A SHARP-CRESTED PARABOLIC WEIR.

(b) Laboratory project. (c) Prof. R. Boucher and assistants.

(e) Experimental project for general information.

(f) To obtain the head - discharge curves and head - discharge coefficient curves for a sharp-crested parabolic weir (21 inches maximum width by 18 inches maximum height) having a capacity of 3 cfs. This weir will measure flows to a new 18-inch by 30-inch glass-sided steel flume to be used for model testing and open channel studies.

(g) The brass weir plate was attached to the face of its stilling basin and the tests conducted on the whole set-up as to be used with the flume. Heads were determined in a stilling pot with a point gauge and discharges were measured by volume for larger flows and by weight for small flows.

(h) Tests completed. Computations partly completed. Report expected early next year.

UNIVERSITY OF TORONTO, Hydraulic Laboratory, Toronto 5, Canada.

Inquiries concerning Project No. 269 and 270 should be addressed to Prof. G. Ross Lord, Dept. of Mechanical Engineering, University of Toronto, Toronto 5, Canada.

(269) FLOW OVER SKEW SPILLWAYS.

(b) Laboratory project. (c) G. R. Lord, D. G. Huber.

(e) Experimental research.

(f) To obtain discharge coefficients for spillways whose crests are at other than 90° to the axis of the approaching flow.

(g) It is hoped that the coefficients obtained will permit more accurate design of skew spillways.

(h) Most of the experimental work has been completed.

(270) ROCK FILL WEIRS.

(b) Laboratory project. (c) G. R. Lord. (e) Experimental research.

(f) To investigate the shape and discharge coefficients of weirs formed by dropping rock into flowing water.

(g) The series of tests is planned to yield data which may be used to design rock fill weirs such as those already constructed at DeCew Falls Power Plant of the Hydro Electric Power Commission of Ontario.

(h) The experimental work is half completed.

COMPLETED PROJECTS

(Project numbers, where given, refer to Volume X, 1942.)

CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.

Inquiries concerning the following five projects (Nos. 1269 to 830, incl.) should be addressed to Prof. Robert T. Knapp, California Institute of Technology, Pasadena, Calif.

(1269) HYDRAULIC DESIGN OF BAFFLE TYPE ENERGY DISSIPATORS FOR PIPE OUTLETS.

(b) Research Division, Soil Conservation Service, U. S. Dept. of Agriculture.

(c) V. A. Vanoni, J. T. Rostron. (e) Experimental project.

(f) To obtain general design formulas for a pipe outlet structure.

(h) Completed.

(i) "Baffle type energy dissipators for pipe outlets." Vito A. Vanoni and James T. Rostron. Agricultural Engineering, Vol. 25, Nos. 8, 9: 301-304. August 1944. 341,348. September 1944.

(822) STUDY OF EFFECT OF AIR CONTENT ON CAVITATION PERFORMANCE OF CENTRIFUGAL PUMPS.

(b) Laboratory project. (c) Th. von Kármán, R. T. Knapp, R. L. Daugherty.

(h) This investigation has been completed and the results included in office reports.

(827) DETERMINATION OF BOTH AVERAGE AND INSTANTANEOUS VELOCITY AND PRESSURE DISTRIBUTIONS IN THE VOLUTE OF A CENTRIFUGAL PUMP.

(b) Hydraulic Machinery Laboratory Research Program.

(c) Th. von Kármán, R. T. Knapp, R. L. Daugherty. (e) Experimental project.

(f) Experimental verification of the flow characteristics in the pump volute.

(g) By means of a precision dual slide valve and special differential gauge, instantaneous readings of velocity and pressure are obtained. Their correlation with the average distributions furnish an experimental basis for an analytical examination of centrifugal pump performance.

(h) A series of investigations has been completed and the results summarized in an office report.

(829) COMPILATION OF COMPLETE CHARACTERISTIC PERFORMANCE OF CENTRIFUGAL PUMPS OF VARIOUS TYPES AND SPECIFIC SPEEDS.

(b) Hydraulic Machinery Laboratory Research Program.

(c) Th. von Kármán, R. T. Knapp, R. L. Daugherty.

(e) General laboratory investigation.

(h) The project has been completed within a narrow range of specific speeds. The project is being discontinued for the present.

(830) AN EVALUATION OF STEPS NECESSARY IN ANALYTICAL REDUCTION OF DATA OBTAINED FROM PRECISION TESTS OF HYDRAULIC MACHINES.

(b) Hydraulic Machinery Laboratory Research Program.

(c) Th. von Kármán, Robert T. Knapp, R. L. Daugherty.

(e) Laboratory research project.

(f) Refinements in testing equipment and technique require that thorough attention be given to methods of evaluation, including determination of physical constants, if all the advantages of precision tests are to be obtained. Information was collected and analytical methods developed for use in the Hydraulic Machinery Laboratory which are thought to be of general interest and importance.

(h) The study has been completed and the results included in a laboratory report.

UNIVERSITY OF CALIFORNIA, College of Engineering, Fluid Mechanics Laboratory, Berkeley 4, Calif.

Inquiries concerning the following five projects should be addressed to the Chairman, Department of Engineering, University of California, Berkeley 4, Calif.

ARROYO SECO DEBRIS BARRIERS.

(b) Forest Service, U. S. Dept. of Agriculture.

(c) M. P. O'Brien, J. W. Johnson, K. J. Bermel.

(e) Experimental investigation for design purposes.

(f) To obtain information on the best crest design to obtain proper operation, on protection of the downetream bed from scour, on the approximate debris slope that would occur when the debris basins were completely filled, and on the protection of banks at certain localities in the Arroyo Seco Canyon.

(g) Models of two reaches of the Arroyo Seco Canyon near Pasadena were constructed to a 1:50 scale and varioue proposed barriers and barrier systems were investigated for the above-mentioned factors.

(h) Project completed. Four reports and two publications have been made.

(i) Reports on Arroyo Seco Debrie Barriers:

Vol. I. "Brown Canyon debris baein and barrier." K. J. Bermel and R. L. Sanks. 1943.

Vol. II. "Brown Canyon and weir debris basins and barriers." K. J. Bermel. August 1945.

Vol. III. "Report on low and intermediate barriers in the weir barrier reach." G. R. Loucks. August 1945.

Vol. IV. "Report on bank protections." W. U. Garstka. May 1945.

"Movement and deposition of sediment in the vicinity of debris barriers." J. W. Johnson and W. L. Minaker. Trans. American Geophysical Union, Pt. V: 901. April 1945.

"Model study of Brown Canyon debrie barrier." K. J. Bermel and R. L. Sanks. Proc. A.S.C.E., Vol. 72, No. 5: 613. May 1946.

(1045) UNIDIRECTIONAL, TRANSIENT FLOW OF COMPRESSIBLE FLUIDS IN POROUS MEDIA.

(b) Laboratory project. (c) J. A. Putnam.

(e) Experimental and theoretical investigation; PhD. thesis.

(f) To determine the transient behavior of pressure surges resulting from varioue initial boundary conditions and to determine the nature of the theoretical solution of the non-linear second degree differential equation deecribing this and similar phenomena.

(g) A linear, uniformly-packed, eand column was charged with air at an elevated pressure. The pressure at one end was then suddenly reduced to atmospheric and preesure-time histories recorded at various positions along the tube. The experiments were repeated by suddenly applying air at elevated pressure at one end of the column when it was initially at atmoepheric pressure.

(h) Project completed. Publicatione planned.

(i) "Unidirection, transient flow of compressible fluids in porous media." J. A. Putnam. Ph.D. thesis, 1943.

THE SHAPE OF SMALL DROPS WHILE EVAPORATING.

(b) Laboratory project. (c) P. C. Nelson. (e) Graduate thesis.

(f) Part of a projected general experimental study of natural aerosols; their dietribution of sizes of particles; their optical properties; and their meteorological characterietics.

(g) Fog particle eize obtained by allowing particles to settle on microscope cover glass slides coated with cellulose-nitrate. Photo micrographs were taken from below during collection. Size of original drops were obtained from measurement of contact area and relations determined by this study on shape of sessile water drops.

(h) Project completed.

(i) "The shape of small drops while evaporating from cellulose-nitrate-coated surface, and its application to the size and size-dietribution of natural fogs in the San Francisco Bay Region." P. C. Nelson. M.S. thesis, 1945.

UNDERFLOW AND UPLIFT PRESSURE FOR DAMS AND WEIRS ON POROUS MEDIA BY ELECTRIC ANALOGY.

(b) Laboratory research. (c) M. A. Selim. (e) Graduate thesis.

(f) To obtain experimental data for design purposes.

(g) Flow nets for various arrangements of cut-off walls were made in the electric analogy tank.

(h) Work completed.

(i) "Underflow and uplift pressure for dams and weirs on porous media by electric analogy." M. A. Selim. Ph.D. thesis, 1941.

"Uplift pressure on dams." M. A. Selim. Proc. A.S.C.E. December 1945.

(801) FRICTION LOSSES IN ANGULAR-CONTACT THRUST BEARINGS.

The following report has been published:

"Friction torque in ball and roller bearings." (A discussion by Haakon Styri.) Weller Johnson. Mechanical Engineering, Vol. 63, No. 10: 738. October 1941.

AIR AND GAS LIFTS.

R. V. Higgins. 1943.

This thesis was a study of existing literature on air and gas lifts. Particular emphasis was placed on the air-water lift data for the development of a graphical method for performance prediction in terms of dimensionless ratios. Predictions were made by this method of oil-well performance with different gas:oil ratios. (Thesis in typed form only.)

THE GAS LIFT.

H. E. Miller. 1942.

An experimental investigation of an air-water lift with a transparent 1-inch diameter eductor pipe was made. Use of a detergent to reduce surface tension produced definite changes in the operating characteristics of the lift. The results were limited to studies in the range of liquid annular ring formation. (Thesis in typed form only.)

MISCELLANEOUS PUBLICATIONS.

"Laboratory manual (Fluid Mechanics Laboratory)." R. G. Folsom and E. H. Taylor. University of California Press. 1942.

"Theses and reports on fluid mechanics and related fields, 1900-1945." Compiled by J. W. Johnson. October 1945. Mimeographed.

CARNEGIE INSTITUTE OF TECHNOLOGY, Department of Civil Engineering, Schenley Park, Pittsburgh 13, Pa.

Inquiries concerning the following two projects should be addressed to Prof. F. T. Mavis, Head, Civil Engineering Dept., Carnegie Institute of Technology, Pittsburgh 13, Pa.

EFFECT OF SUBMERGENCE ON SHARP-CRESTED WEIRS.

(b) Laboratory project. (c) F. T. Mavis, K. C. Thomas. (e) Graduate thesis.

(f) To study effect of submergence on the discharge of sharp-crested weirs.

(g) Tests were conducted for rectangular, parabolic, triangular, and circular sharp-crested weirs.

(h) Completed; thesis completed.

SUBMERGED FLOW INVESTIGATION OF SUTRO WEIR.

(b) Laboratory project.

(c) F. W. Edwards, S. O. Lyons, W. W. Stuart.

(e) Undergraduate thesis.

(f) To analyze experimentally the effects of submergence on a sutro weir.

(g) Tests were conducted for both free and submerged discharge.

(h) Completed; thesis completed.

COLORADO A & M COLLEGE, Civil Engineering Department, Fort Collins, Colo.

GROUND-WATER SUPPLY OF PROSPECT VALLEY, COLORADO.

W. E. Code, Colorado Agricultural Experiment Station Technical Bulletin 34. 40 pp. October 1945.

Prospect Valley is in northeastern Colorado and has an irrigated area of about 12,500 acres. Water was first applied to the land in 1912, which was carried through canals of a system of which it is a part. Inadequate water supplies led to ground-water development as a means of relief in 1933. Favorable conditions existed for obtaining irrigation wells over a large part of the Valley and by 1944, 87 such wells were being pumped. The water table receded a maximum of 20 feet by 1941, but experienced a substantial recovery during the following three years. The investigation covered the period 1942, 1943, and 1944, although some data were available from the beginning of pumping.

The changing position of the water table during the investigation was determined from measurements in 63 observation wells. Gross volumetric changes were calculated and from the measured withdrawal by pumps and recharge from irrigation and other sources, a specific yield of about 17 percent was determined. The data made it possible to compute the conditions of water supply required for equilibrium and the probable rate of decline for non-equilibrium conditions. The conclusion arrived at was that when the average gravity supply was 5000 acre-feet, the quantity removed by pumping should not exceed 9,900 acre-feet.

THE USE OF CURRENT METERS IN MEASURING PIPE DISCHARGES.

Carl Rohwer, Colorado Agricultural Experiment Station Technical Bulletin 29. 40 pp. September 1942.

Hoff and Ott current meters were employed to measure the flow in 4, 5, 6, 8, 10, and 12-inch standard pipe and 7, 8, and 9-inch OD pipe. The apparent discharge so obtained was checked against measurements made with a Venturi meter and weirs. A comparison of the results made it possible to determine the equation $Q = (419A-5)V$ in which Q is in gallons per minute, A is the pipe area in square feet, and V is the measured velocity in feet per second.

An analysis of the data shows errors of less than 5 percent for 92 percent of the tests. Errors exceeding 5 percent were largely attributed to velocities higher than recommended for a rubber propeller and to the use of short pipes attached to an elbow.

Any propeller meter can be used for this method of measurement, but the propeller must be protected with a guard. A standard meter rating with the guard attached is necessary. The technique in traversing the pipe must follow that used in the laboratory work. Pipes must be flowing full at the point of propeller locations and velocities over 9 fps with the rubber propeller of the Ott meter should be avoided.

CORNELL UNIVERSITY, College of Engineering, Ithaca, New York.

Inquiries concerning the following two projects should be addressed to Prof. E. W. Schoder, College of Engineering, Cornell University, Ithaca, N. Y.

FLOW IN CIRCULAR PIPES PARTLY FULL.

(b) Laboratory research; master's thesis. (c) M. J. Willis.

(e) To test validity of the commonly assumed variations of "hydraulic elements" with depth.

(g) A 12-inch pipe 40 feet long with access slots cut along the top, and arranged to give slopes up to 0.15, provided with a special entry nozzle to create stable velocity for a given depth and slope, and equipped with two types of piezometers as well as point gages.

(h) Thesis completed.

(i) Short paper in preparation. Further experimental study is suggested by

certain features in common with Project No. 1242, "Steel open channels", and Project No. 1243, "Velocity distribution in open channels", reported in Vol. IX, January 1941.

FLOW IN OPEN CHANNELS WITH ARTIFICIAL ROUGHENING.

(b) Laboratory research; Ph.D. thesis. (c) Hsuan Kuo.

(f) To help towards classification of surface roughness.

(g) Using three 90° V-shaped wooden flumes 28 feet long, at first with smooth varnished surfaces, then progressively roughened with projecting heads of brass escutcheon pins, the shape closely resembling standard steel rivet heads. The average diameters of the three sizes of round brass heads used were 0.0627, 0.01138, and 0.2228 inches, and the average heights above the smooth surface of the flume were 0.0233, 0.0429, and 0.0835 inches, respectively, approximately in one-two-four relative sizes. The center to center spacings used were twelve, six, and three times the diameters of the heads, arrangement being in staggered (equilateral triangular) pattern. Water depths ranged from 0.02 to 0.50 foot, slopes from 0.005 to 0.09.

(h) Thesis completed. Short paper in preparation.

UNIVERSITY OF ILLINOIS, College of Engineering, Urbana, Ill.

THE BACKWATER PROFILE FOR STEADY FLOW IN A RECTANGULAR CHANNEL AND ITS SIGNIFICANCE IN THE STAGE - FALL - DISCHARGE RELATION.

(b) Laboratory problem. (c) E. G. Barron, W. D. Mitchell, W. M. Lansford.

(d) Prof. F. B. Seely, Head, Dept. of Theoretical and Applied Mechanics, 214 Talbot Laboratory, University of Illinois, Urbana, Ill.

(e) This laboratory problem developed into master's theses for Mr. Barron and Mr. Mitchell under the direction of Prof. Lansford. The project was experimental. General information was obtained.

(f) To obtain data on backwater surfaces.

(g) A rectangular channel 5 feet by 5 feet by approximately 163 feet with a wooden floor and concrete side walls was used. Artificial roughness was used on floor only and on floor and side walls to obtain desired value of "n". A slope of 0.003 was used.

(h) Theses completed and on file in University library.

STATE UNIVERSITY OF IOWA, Iowa Institute of Hydraulic Research, Iowa City, Iowa.

(1025) STUDY OF EQUIPMENT AND TECHNIQUE FOR SUSPENDED SEDIMENT SAMPLING AND ANALYSIS.

(b) Cooperative project, U. S. Depts. of War, Interior, Agriculture, Tennessee Valley Authority, and Iowa Institute of Hydraulic Research.

(i) Reports published by the U. S. Engineer, St. Paul District Sub-Office at the Hydraulics Laboratory, Iowa City, Iowa. List of reports is included under Project No. 194, Corps of Engineers, St. Paul District.

GRADUATE THESES

"An experimental study of the flow of water through transitions in rectangular open channels." G. B. Lyon. M.S., February 1942.

"The removal of air from pipelines by flowing water." P. H. Bliss. M.S., May 1942.

"A study of possible extensions of the Huai River flood control plan." P. F. Chu. M.S., July 1942.

"Effect of aeration rates upon discharge over a sharp-crested weir." C. C. Lomax, Jr. M.S., February 1942.

"Ground water flow in Rapid Creek watershed." M. L. Albertson. M.S., July 1942.

"Comparison of model and prototype performance of two Miami Conservancy District retarding basin stilling pools." J. D. Lee. M.S., May 1942.

"A study of transportation of fine sediments by flowing water." C. H. Hsia. Ph.D., July 1943.

"Measurements of velocity distribution around a stationary ship model in flowing water." W. S. Hamilton. Ph.D., December 1943.

"A study of stream meanders." D. Escobar E. M.S., April 1944.

"Roller type stilling action." H. W. Feldt. M.S., August 1945.

"Experimental study of the free overfall as a function of the Froude number." J. M. Montana. M.S., April 1945.

"A study of a method for computing sediment deposits in retarding basins." K. Lei. M.S., February 1946.

"Effect of vacuum on free nappe." L. A. Thorssen. M.S., June 1946.

"Control of the hydraulic jump by sills." J. W. Forster and R. A. Skrinde. M.S., February 1947.

"Distribution of velocity in turbulent jets of air." Y. B. Dai. M.S., February 1947.

"An experimental study on backwater curves." H. H. Hu. M.S., February 1947.

"An experimental study of the boundary influence on the motion of falling spheres." H.-M. Lee. M.S., February 1947.

STAFF PUBLICATIONS.

"Proceedings of the Second Hydraulics Conference", edited by J. W. Howe and H. Rouse. University of Iowa Studies in Engineering, Bulletin 27. 1943.

"The Iowa Institute of Hydraulic Research". University of Iowa Studies in Engineering, Bulletin 30. 1946.

"Proceedings of the Third Hydraulics Conference", edited by J. W. Howe and J. S. McNown. University of Iowa Studies in Engineering. 1947.

"Evaluation of boundary roughness". H. Rouse. Proceedings of the Second Hydraulics Conference. University of Iowa Studies in Engineering, Bulletin 27. 1943.

"A general stability index for flow near plane boundaries." H. Rouse. Journal of the Aeronautical Sciences, Vol. 12, No. 4. October 1945.

"Elementary mechanics of fluids." H. Rouse. Wiley, 1946.

"Use of the low-velocity air tunnel in hydraulic research." H. Rouse. Proceedings of the Third Hydraulics Conference. 1946.

"Gravitational diffusion from a boundary source in two-dimensional flow." H. Rouse. Proceedings of the Sixth International Congress for Applied Mechanics, Paris. 1946.

"Measurement of sediment transportation." E. W. Lane. Proceedings of the Second Hydraulics Conference. University of Iowa Studies in Engineering, Bulletin 27. 1943.

"The effect of cutting off bends in rivers." E. W. Lane. Proceedings of the Third Hydraulics Conference. 1946.

"Effects of channel shape losses in canal bend." C. H. Yen and J. W. Howe. Civil Engineering. January 1942.

"Characteristics of high-velocity jets." J. W. Howe and C. J. Posey. Proceedings of the Third Hydraulics Conference. 1946.

"Criteria for determining sand transport by surface creep and saltation." A. A. Kalinske. Trans. American Geophysical Union. 1942.

"Role of turbulence in river hydraulics." A. A. Kalinske. Proceedings of the Second Hydraulics Conference. University of Iowa Studies in Engineering, Bulletin 27. 1943.

"Air entrainment in closed conduit flow." A. A. Kalinske and J. M. Robertson. Trans. A.S.C.E., Vol. 108: 1435. 1943.

"Experiments on eddy diffusion and suspended material transportation in open channels." A. A. Kalinske and C. L. Pien. Trans. American Geophysical Union: 531. 1943.

"Removal of air from pipe lines by flowing water." A. A. Kalinske and P. H. Bliss. Civil Engineering. October 1943.

"Eddy diffusion." A. A. Kalinske and C. L. Pien. Industrial and Engineering Chemistry, Vol. 36: 220. 1944.

"Design and operation of grease interceptors." A. A. Kalinske and F. M. Dawson. Sewage Works Journal, Vol. 16. 1944.

"Study of transportation of fine sediments by flowing water." A. A. Kalinske and C. H. Hsia. University of Iowa Studies in Engineering, Bulletin 29. 1945.

"Conversion of kinetic to potential energy in flow expansion." A. A. Kalinske. Proc. A.S.C.E.: 1545. December 1944.

"Application of statistical theory to velocity and suspended sediment measurement in rivers." A. A. Kalinske. Trans. American Geophysical Union. 1945.

"Problems and solutions and questions and answers for Rouse: Elementary mechanics of fluids." J. S. McNown. Wiley, 1946.

"Pressure distribution and cavitation on submerged boundaries." J. S. McNown. Proceedings of the Third Hydraulics Conference. 1946.

REPORTS ON WARTIME RESEARCH PROJECTS.

"Scale model studies of the movement of smoke and gas clouds." Hunter Rouse. NDRC Informal Report No. 10.3A-36. October 10, 1943.

"Wind-tunnel studies of the diffusion of heat from a line source." Hunter Rouse, M. L. Albertson, R. A. Jensen, and C. F. Schadt. NDRC Informal Report No. 10.2-12. March 18, 1944.

"Fog-dispersal recommendations for the Island of ....." H. Rouse, M. L. Albertson, R. A. Jensen, and C. F. Schadt. Informal Report to the NDRC. December 1944.

"The Iowa radiant burner." H. O. Croft and J. M. Trummel. Informal Report to the NDRC. April 30, 1945.

"Development of a fog-dispersal burner for gasoline and fuel oil." M. L. Albertson. Informal Report to the NDRC. June 15, 1945.

"Wind-tunnel studies of the diffusion of heat by single wind curtains and baffles." H. Rouse, M. L. Albertson, R. A. Jensen, and C. F. Schadt. NDRC Formal Report No. 4334. November 11, 1944.

"Wind-curtain installations for fog dispersal." R. A. Jensen. Informal Report to the NDRC. July 16, 1945.

"Wind-tunnel studies of the diffusion of gas in schematic urban districts." H. Rouse, M. L. Albertson, R. A. Jensen, and C. F. Schadt. NDRC Informal Report No. 10.3A-46. May 9, 1944.

"Diffusion of smoke and gas by wind." Motion picture prepared for the Chemical Warfare Service by the Iowa Institute of Hydraulic Research through Division 10 of the NDRC.

"Wind-tunnel studies of gas diffusion in a typical Japanese urban district." A. A. Kalinske, R. A. Jensen, and C. F. Schadt. NDRC Informal Report No. 10.3A-48. June 8, 1945.

"Correlation of wind-tunnel studies with field measurements of gas diffusion." A. A. Kalinske, R. A. Jensen, and C. F. Schadt. NDRC Informal Report No. 10.3A-48a. September 29, 1945.

"Preliminary wind-tunnel studies on air flow over mountainous terrain." A. A. Kalinske, R. A. Jensen, and C. F. Schadt. Informal Report to the NDRC. July 25, 1945.

"Description of 10-foot channel and appurtenances for tests on stationary ship models in flowing water." Iowa Institute of Hydraulic Research. Report No. 1 to the David Taylor Model Basin, Bureau of Ships, U. S. Navy. July 29, 1942.

"Test of a stationary ship model in a 10-foot channel." Iowa Institute of Hydraulic Research. Report No. 2, DTMB. December 14, 1942.

"Test of a stationary ship model in a 16-foot channel." Iowa Institute of Hydraulic Research. Report No. 3, DTMB. May 5, 1943.

"Tests of stationary ship models in a 16-foot channel." Iowa Institute of Hydraulic Research. Report No. 4, DTMB. November 15, 1943.

"Resistance tests on ship model and friction plane in 16-foot and 11-foot channels." Iowa Institute of Hydraulic Research. Report No. 5, DTMB. July 30, 1945.

"Cavitation tests in the Iowa variable pressure water tunnel." H. Rouse, J. S. McNown, and E.-Y. Hsu. Informal Reports to the NDRC:

"Tunnel characteristics and test procedure for bodies of revolution." November 30, 1944.

"Cylindrical body with hemispherical head." December 4, 1944.

"Cylindrical body with blunt head." December 8, 1944.

"Cavitation tests on a systematic series of torpedo heads." H. Rouse, J. S. McNown, E.-Y, Hsu, and C. A. Lamb. Informal Reports to NDRC and DTMB:

"Water tunnel characteristics and test procedure." NDRC. February 22, 1945.

"Hemispherical head." NDRC. February 28, 1945.

"Blunt head." NDRC. March 5, 1945.

"1/4-caliber rounded head." NDRC. March 10, 1945.

"1/8-caliber rounded head." NDRC. March 15, 1945.

"1-caliber ogival head." NDRC. March 20, 1945.

"2-caliber ogival head." NDRC. March 26, 1945.

"45° conical head." DTMB. June 1945.

"90° conical head." DTMB. June 1945.

"135° concave conical head." DTMB. June 1945.

"2:1 ellipsoidal head." DTMB. July 1945.

"1:2 ellipsoidal head." DTMB. July 1945.

"1:2 concave ellipsoidal head." DTMB. July 1945.

"Hollow cylindrical head." DTMB. August 1945.

"Summary of cavitation tests on a systematic series of rounded torpedo heads." H. Rouse, J. S. McNown, and E.-Y. Hsu. Informal Report to NDRC. May 31, 1945.

"Summary of cavitation tests on a systematic series of ellipsoidal torpedo heads." H. Rouse, J. S. McNown, E.-Y. Hsu, and C. A. Lamb. Report to DTMB. October 1945.

"Summary of cavitation tests on a systematic series of conical torpedo heads." J. S. McNown, E.-Y. Hsu, and C. A. Lamb. Report to DTMB. November 1945.

"Summary of cavitation tests on modified hemispherical heads." J. S. McNown, E.-Y. Hsu, and C. A. Lamb. Report to DTMB. January 1946.

"Cavitation tests on a half-body torpedo head." J. S. McNown, E.-Y, Hsu, and C. A. Lamb. Report to DTMB. April 1946.

"Fire-monitor investigation." J. W. Howe and C. J. Posey, with M. L. Albertson, J. R. Barton, and E. M. Laursen. Preliminary report to DTMB. October 1945.

"Review of experimental and theoretical studies of flow behind grids." J. S . McNown and M. L. Albertson. Informal report to DTMB. October 1945.

LEHIGH UNIVERSITY, Department of Civil Engineering, Bethlehem, Pa.

THE INFLUENCE OF VISCOSITY ON CENTRIFUGAL PUMP PERFORMANCE.

Arthur T. Ippen. A.S.M.E. Paper No. A-45-57. November 1945.

THE EFFECT OF LATERAL CONTRACTIONS ON SUPERCRITICAL FLOW IN OPEN CHANNELS.

John Howard Dawson, Master's thesis, Lehigh University. 1943.

Theoretical and experimental study, shows advantages of abrupt corners in such transitions for particular velocities.

LOUISIANA STATE UNIVERSITY AND A & M COLLEGE, Dept. of Hydraulic Engineering, University Station, Baton Rouge 3, La.

(28) HYDROLOGICAL STUDY OF CITY PARK LAKE DRAINAGE AREA.

(224) FACTORS AFFECTING THE EVAPORATION FROM A LAND PAN.

(225) COMPARISON OF EVAPORATION BETWEEN A LAND PAN AND A FLOATING PAN.

The above three projects have been completed, written up, and published as an Engineering Experiment Station Bulletin of Louisiana State University, under the following title:

"A summary of hydrologic data, Bayou Duplantier Watershed, 1933-1939." Glen N. Cox. Studies in Engineering, No. 5. 1940.

UNIVERSITY OF MINNESOTA, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

MODELS FOR STUDY OF SPILLWAY STRUCTURES FOR PROPOSED SAN JACINTO RIVER DAM.

(b) City of Houston, Tex. (c) L. G. Straub, A. G. Anderson, W. W. DeLapp.

(d) Dr. Lorenz G. Straub, Director, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

(e) Experimental model study.

(f) To establish hydraulic design of spillway and operational procedure.

(g) Section models built to scales of 1:55 and 1:15 used to study flow and erosion patterns for complete range of discharges. Section models and three-dimensional models to scale of 1:55 used to design low water spillway section and establish operating procedure.

(h) Completed; report submitted to City of Houston.

OUTLET FOR CULVERTS AND CHUTES.

(b) Division of Drainage and Water Control, Soil Conservation Service, U. S. Dept. of Agriculture, in cooperation with Minnesota Agricultural Experiment Station.

(c) F. W. Blaisdell.

(d) Fred W. Blaisdell, Soil Conservation Service, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

(e) To develop a generalized design.

(f) To develop an outlet whose performance can be predicted without recourse to further model study.

(g) Outlet developed for Froude numbers of three or greater. Design is based on hydraulic jump with the proportions of the stilling basin determined experimentally.

(h) Project completed.

(i) Outlet developed has been named "The SAF Stilling Basin".

"Tests of a standard culvert outlet for use with drop inlet culverts." F. W. Blaisdell. October 1941.

"Tests of culvert and flume outlet structures." Supplemental report on tests of culvert and flume outlet structures. F. W. Blaisdell. December 1942 and December 1943.

"The SAF stilling basin." F. W. Blaisdell. December 1943.

(Above publications available for loan.)

MODEL TESTS OF OUTLET STRUCTURE, LOWER CANEY LAKE, MINDEN, LOUISIANA.

(b) Region Four Engineering Division, Soil Conservation Service, Ft. Worth, Tex.

(c) F. W. Blaisdell.

(d) Fred W. Blaisdell, Soil Conservation Service, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

(e) To obtain data for design purposes. (f) To check the design.

(g) A 1:9 Lucite model of the transition and SAF stilling basin were tested with a movable bed channel, and desirable modifications of the transition and wingwall design were made.

(h) Study completed.

(i) "Report on hydraulic model tests of outlet structure to be built at Lower Caney Lake, Minden, Louisiana." F. W. Blaisdell. September 1946. (Available for loan.)

TEST OF AN AUTOMATIC DRAINAGE GATE.

(b) Division of Drainage and Water Control, Soil Conservation Service, U. S. Dept. of Agriculture, in cooperation with Minnesota Agricultural Experiment Station.

(c) S. H. Anderson.

(d) Fred W. Blaisdell, Soil Conservation Service, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

(e) To obtain data for design purposes.

(f) To determine performance and check design.

(g) Operation of gate is based on the principle that the center of pressure occurs at two-thirds the depth. A wooden gate 3-1/2 feet wide by 5 feet high was tested in a channel 9 feet wide by 6 feet deep. Tests resulted in an improved design.

(h) Project completed.

(i) "Report on a test of an automatic drainage gate." S. H. Anderson. August 1945. (Available for loan.)

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY, Newport News, Va.

Inquiries concerning the following eleven projects should be addressed to Mr. C. H. Hancock, Hydraulic Laboratory and Ship Model Testing Basin, Newport News Shipbuilding and Dry Dock Company, Newport News, Va.

STRUT BEARING TEST.

(b) Engine Technical Dept., Newport News Shipbuilding and Dry Dock Company.

(c) W. F. Taylor, K. S. Black. (e) Experimental, design data.

(f) To obtain design data and improve the water passages for inducing circulation in water lubricated rubber strut and outboard propeller shaft bearings.

(g) Model scoops were tested at various velocities in a closed test channel to determine the induced head for various quantities of flow through the shaft bearing scoop. Shaft remained stationary in these tests.

(h) Completed.

DECK EDGE ELEVATOR TESTS.

(b) Engine Technical Dept., Newport News Shipbuilding and Dry Dock Company.

(c) W. F. Taylor, J. R. Kane, R. L. Noland. (e) Experimental, design data.

(f) To study the dynamic forces on a deck edge elevator platform heeled into the crest of a wave, both with and without protecting sponsons forward to obtain structural design data.

(g) Model deck edge elevator placed at an angle in an open test channel and forces measured with a six component dynamometer.

(h) Completed.

PARAVANE SHOE TESTS.

(b) Hull Technical Dept., Newport News Shipbuilding and Dry Dock Company.

(c) S. B. Besse. (e) Experimental and design.

(f) To design an inclined plane type of paravane shoe that will use the dynamic

forces around the bow of a ship to lower itself while the ship is under way.

(g) A model of the forward part of a ship was fixed in a channel of moving water. Model paravane shoes were tested at various stream velocities.

(h) Completed.

(i) Paper before the Fourth Annual American Towing Tank Conference. Transactions of the Society of Naval Architects and Marine Engineers, Vol. 49. 1941.

CONDENSER SCOOP TESTS.

(b) Engine Technical Dept., Newport News Shipbuilding and Dry Dock Company.

(c) W. F. Taylor, B. R. Lee. (e) Experimental, design data.

(f) Obtain design data and improve the efficiency of condenser circulation scoops for ships.

(g) Model scoops were tested in a closed channel and the induced heads vs flow through scoop determined. A suitable boundary layer was created by roughening the wall of the channel ahead of the scoop models.

(h) Closed.

(i) "Condenser scoop design." E. F. Hewins and J. R. Reilly. Trans. Society of Naval Architects and Marine Engineers, Vol. 48: 277-297. 1940.

NOZZLE TESTS FOR AMMUNITION STOWAGE ROOMS.

(b) Engine Technical Dept., Newport News Shipbuilding and Dry Dock Company.

(c) W. F. Taylor, B. R. Lee. (e) Experimental, for design information.

(f) Investigation of four spray nozzles to determine their ability to wet down and thus cool a ship's ammunition stowage room.

(g) Area covered by water from nozzle spraying on a glass plate from beneath determined at various pressures and quantities of water and various nozzle distances from the glass.

(h) Completed.

DECK EDGE ELEVATOR TEST.

(b) Hull Technical Dept., Newport News Shipbuilding and Dry Dock Company.

(c) W. F. Taylor. (e) Experimental, design data.

(f) To investigate qualitatively the tendency, if any, of a deck edge elevator platform to cause a ship to heel, when the platform is momentarily immersed in a wave crest.

(g) Dynamically balanced ship model fitted with a model deck edge elevator platform outboard from the main deck. Model towed at tow rope pull for designed speed in various sized waves on an even keel and at a 20° heel, and with the platform inclined 5° lower forward.

(h) Completed.

SHIP'S SWIMMING POOL SURGING TEST.

(b) Hull Technical Dept., Newport News Shipbuilding and Dry Dock Company.

(c) W. F. Taylor, J. F. Snyder. (e) Experimental, design data.

(f) To determine experimentally the efficiency of wave traps designed to keep the water in the swimming pool from splashing onto the deck; to check experimentally a formula for finding the period of surge in rectangular pools of uniform depth; and to investigate the subject of surge in ships' swimming pools.

(g) A model of the ship's swimming pool, complete with interchangeable wave traps, was fastened to a crank and moved to simulate pitching of the ship. Both period and amplitude were variable. The formula was checked by filling a rectangular tank of varying dimensions with various depths of water and finding the period by counting the surges and by finding the periods of oscillation which produced synchronism. Various designs and locations of pools were investigated, as well as the effect of false bottoms on the period as given by the formula.

(h) Completed.

CARRIER IN WAVES.

(b) Hull Technical Division, Newport News Shipbuilding and Dry Dock Company.

(c) B. R. Lee, K. S. Black. W. C. Madison, W. T. Radcliffe.

(e) Experimental, design problems.

(f) To investigate water loads on the flight deck of an aircraft carrier running head on into waves of various lengths.

(g) Dynamically similar model towed head on in waves. Results recorded by slow motion pictures.

(h) Completed.

WILMINGTON LAUNCHING TEST.

(b) North Carolina Shipbuilding Corporation, Wilmington, N. C.

(c) R. H. Pepper, P. R. Keffer, Jr., W. F. Taylor.

(e) Experimental, launching data.

(f) To investigate the efficiency of various drags used to swing ships into the channel during launching and to plot the path that would be taken by the ship.

(g) Dynamically ballasted model was towed down one side of the 56-foot model basin and released at a given point. The stern drag then took effect and swung the model around simulating the prototype. A camera located directly above the tank photographed a set of intermittent lights. Analysis of the light trace photographs yielded position, velocity, and heading, and in some cases the load on a small dynamometer.

(h) Completed.

RESTRICTED CHANNEL 1.

(b) David Taylor Model Basin, U. S. Navy.

(c) W. F. Taylor, C. C. Garrison, R. H. Pepper. (e) Experimental.

(f) To determine the speed and behavior of selected typical combatant vessels in a canal of a given width and sloping sides.

(g) The models were towed in water at the scale width and depth. Wave patterns were photographed and trim and sinkage data were taken.

(h) Completed.

(i) These tests were mentioned in Commander E. A. Wright's paper, "A pattern for research in Naval architecture", read before the Society of Naval Architects and Marine Engineers, 1946.

CARRIER LAUNCHING CLEARANCES.

(b) Hull Technical Division, Newport News Shipbuilding and Dry Dock Company.

(c) W. F. Taylor, B. R. Lee, K. S. Black. (e) Experimental, launching data.

(f) To find the horizontal clearance of a CVB launched eccentrically.

(g) A dynamically similar model was launched from model ways.

(h) Completed.

THE OHIO STATE UNIVERSITY, Department of Mechanical Engineering, Columbus 10, Ohio.

(526) DETERMINATION OF COEFFICIENTS OF DISCHARGE OF FLOW NOZZLES.

(b) Fluid Meter Committee, A.S.M.E.

(d) Prof. S. R. Beitler, Professor of Hydraulic Engineering, The Ohio State University, Columbus 10, Ohio.

(h) Material from tests conducted by committee has been given to Engineering Experiment Station for publication of all data and results. Probable date of publication is September 1947.

PENNSYLVANIA WATER & POWER COMPANY, 1611 Lexington Building, Baltimore, Md.

ON THE USE OF A RADIOACTIVE-TRACER METHOD IN MEASUREMENTS OF WATER.

V. F. Hess. Trans. American Geophysical Union. 1943.

Work on the tracer method of water measurement was initiated in 1940 when radium was investigated as a radioactive tracer. Ionization chambers and an electrometer were used to measure the weak radium solutions. The lower limits of concentration were established below which precise measurements were not possible. For testing large turbines, radium as a tracer was found to have serious limitations.

PURDUE UNIVERSITY, School of Civil Engineering and Engineering Mechanics, Lafayette, Ind.

FLOW OF WATER THROUGH SMALL SWING-CHECK VALVES.

F. W. Greve, Professor of Hydraulic Engineering, Purdue University. Engineering Experiment Station Research Series No. 88, Vol. XXVII, No. 3. 20 pp. May 1943.

The brass valves, 0.50, 0.75, 1.0, 1.5, and 2.0 inches in size, were tested in the Hydraulic Laboratory with water ranging in temperature from 67.5 to 74.1 deg F. The loss of head remained almost constant for all valves when the velocity of flow in the pipe to which the valve was attached was 1.0 fps or less. With velocities greater than unity, the lost head and the Reynolds number increased at a decelerating rate with increase in velocity of flow and decreased with increased size for a stated velocity. Apparently a minimal velocity of flow between 5 and 6 fps in a pipe is necessary to maintain the check in an accompanying valve in a wide-open position.

FLOW OF LIQUIDS THROUGH VERTICAL CIRCULAR ORIFICES AND TRIANGULAR WEIRS.

F. W. Greve, Professor of Hydraulic Engineering, Purdue University. Engineering Experiment Station Research Series No. 95, Vol. XXIX, No. 3. 68 pp. May 1945.

All orifices and weirs were cut from smooth brass plates, 0.25 inches thick. The upstream edge of each aperture was square with the inner face of a plate. Beveling a plate at an angle of 30° to the plane of an orifice or a weir made certain that the escaping stream touched the boundary of an opening along a line represented by the upstream edge. The diameters of the orifices were 0.252, 0.381, 0.502, 0.625, 0.754, 0.875, 1.00, 1.50, and 2.00 inches, and the central angles of the weirs were 30, 60, and 90 deg. Included among the liquids used were cylinder oil, furnace oil, mixtures of cylinder and furnace oils, soap solutions, admixture of DuPont's alkanol and water, sucrose solutions, and water. The range in temperature and physical properties of the fluids was as follows: (a) temperature, 58 to 178 deg F; (b) density, 1.61 to 2.45 slugs/cu ft; (c) surface tension, 0.00196 to 0.00526 lb/ft; and kinematic viscosity, 0.000 003 91 to 0.001 82 sq ft/sec. The range in ratio of head to diameter for the orifices was from 0.514 to 27.8, while the smallest head on a weir was 1.44 inch and the largest was 6.48 inches.

The following conclusions were deduced within the limits of the test data. For circular orifices: (a) no simple definite relation exists between the discharge coefficient and either the Reynolds or the Weber number; (b) the critical, or maximal, discharge coefficient varied less than 2 percent for a given orifice, irrespective of the liquid issuing therefrom; (c) the critical discharge coefficient occurred at a critical head, which head was dependent upon the diameter of the orifice and the kinematic viscosity of the fluid; (d) the critical discharge coefficient varied inversely with the diameter of the orifice; and (e) the critical head for all orifices was a minimum when the kinematic viscosity of the liquid was approximately 0.000 03 sq ft/sec. For the weirs: (a) the discharge coefficient decreased with increase in head; (b) the data were insufficient to establish a possible mathematical relation between the discharge coefficient and the Reynolds number; and (c) the surface tension of a liquid did not affect the discharge coefficient.

S. MORGAN SMITH COMPANY, York, Pa.

Inquiries concerning the following five projects should be addressed to Mr. George A. Jessop, Chief Engineer, S. Morgan Smith Company, York, Pa.

SMITH KAPLAN TURBINE. EFFICIENCY, HORSEPOWER, CAVITATION, RUNAWAY SPEED, AND HYDRAULIC THRUST TESTS.

(b) Government of Uruguay, Rio Negro Plant.

(c) R. Sahle and laboratory personnel. (e) Experimental research.

(f) To determine the horsepower and efficiency of a full-size Smith-Kaplan turbine to obtain enough data to compare results over the entire range of head from 54 ft to 110 ft head. To determine the cavitation limits, the maximum runaway speed, and hydraulic thrust.

(g) Tests were conducted on a Smith-Kaplan turbine. The draft tube, spiral casing, and stay vanes had been installed and had been manufactured by another company. New wheel case parts and runner of S. Morgan Smith Company design were used. Two models were made: one 16-inch diameter for the efficiency and power tests, and one 10-inch diameter for cavitation, runaway speed, and hydraulic thrust tests. On both models the blades of the runner were adjustable and tests were made at six different blade angles. At each blade position, the tests covered a large range of speeds and a sufficient number of gate openings to determine comparative results over the entire range of heads. The cavitation test determined the limits of horsepower at all heads which can be obtained in the field. Runaway speed was determined for all heads and values of sigma.

(h) Tests were completed September 23, 1942.

FRANCIS TYPE REVERSIBLE PUMP AND TURBINE EFFICIENCY, HORSEPOWER, CAVITATION, RUNAWAY SPEED, AND HYDRAULIC THRUST TESTS.

(b) Canadian General Finance Company, Ltd., Sao Paulo Tramway Light and Power Company, Ltd., Pedreira Pumping Plant No. 5.

(c) R. Sahle and laboratory personnel. (e) Experimental research.

(f) To determine the discharge and efficiency of a full-size Francis type reversible impeller when operating as a pump over the entire range of head from 59 ft to 101.7 ft head. To determine the horsepower and efficiency when operating as a turbine over the entire range of head from 59 ft to 98.4 ft head. To determine the cavitation limits, the hydraulic thrust, and runaway speed.

(g) A model was made of a special design spiral casing, elbow draft tube, and wheel case. Tests were conducted when operating as a pump and as a turbine over a large range of speeds and sufficient number of gate openings so that a curve could be drawn to determine the exact opening to produce maximum efficiency. The purpose of these tests was to determine the performance of the unit when operating at a fixed speed, both as a turbine and as a pump. Cavitation tests were made on the same model setting and the value of sigma determined by the usual method. Runaway speed tests were conducted at various gate openings. Maximum hydraulic thrust was also obtained when operating both as a turbine and as a pump.

(h) Tests were completed February 1, 1945.

ADJUSTABLE BLADE SMITH-KAPLAN TURBINE EFFICIENCY, HORSEPOWER, AND CAVITATION TESTS. SIX-BLADE RUNNER DESIGN.

(b) S. Morgan Smith Company.

(c) R. Sahle and laboratory personnel. (e) Experimental research.

(f) To determine the efficiency, horsepower, and cavitation limits on a six-blade Smith-Kaplan turbine.

(g) Tests were conducted with a six-blade runner, the blades being adjusted manually. The runner was installed on an elbow draft tube of standard design, and the tests were run in an open flume setting.

(h) Tests were conducted in June 1943.

ADJUSTABLE BLADE AXIAL FLOW PUMP. EFFICIENCY, HORSEPOWER, AND DISCHARGE TESTS.

(b) David Taylor Model basin, U. S. Navy.

(c) G. Dugan Johnson and laboratory personnel. (e) Experimental research.

(f) To determine the discharge, the horsepower, and the efficiency of a full-size axial flow pump under field heads.

(g) A model was made of the suction chamber, discharge tube, two-blade pump impeller, and its casing. Tests were conducted to determine the efficiency, horsepower, and discharge at a number of blade angles and over a sufficiently large range of speed to cover the required proportional speeds as determined by field conditions.

(h) Tests were completed March 3, 1942.

ADJUSTABLE BLADE AXIAL FLOW PUMP EFFICIENCY AND DISCHARGE TESTS.

(b) Pusey & Jones Corporation, Wilmington, Del.

(c) R. Sahle and laboratory personnel. (e) Experimental research.

(f) To determine the discharge and efficiency of a full-size axial flow pump under field heads.

(g) A complete model of the full-size unit was made and tested. The suction chamber, being of special design, was provided with Lucite windows for observation of the flow conditions. Several sets of guide vanes were installed and results determined. The pump is mounted horizontally.

(h) Tests were completed March 11, 1946.

STANFORD UNIVERSITY, School of Engineering, Stanford University, Calif.

(889) CHARACTERISTICS OF BORE WAVES.

Project discontinued.

(890) VARIABLE DISCHARGE OF A RECTANGULAR CHANNEL.

"Varied flow in a rectangular open channel." C. MacLain Adams. Stanford University thesis. 1939. (Available by interlibrary loan.)

Within the range of unsteadiness attained with the apparatus built in the laboratory it was found that the various forces so nearly balanced that evaluation of the residual friction term became almost entirely dependent upon the slope of the bottom. It may be concluded therefore that friction within that range of unsteadiness is probably not appreciably different from that obtained in steady flow.

(1019) STEEP SLOPE FLOW PHENOMENA.

"Report on steep slope flow." J. Hedberg. Trans. American Geophysical Union, Pt. I: 74-76. 1942.

This project was discontinued due to the death of Dr. Hedberg. The above report is the last progress report on the project.

(1020) FLOW OF FLUIDS IN FRACTIONATING COLUMNS.

"Characteristics of flow in a fractionating column." C. B. Lusk. Stanford University thesis. 1941. (Available by interlibrary loan.)

Fractionating column operating at the maximum efficiency. For large air flow rates, the pressure drop per tray is primarily a function of the design of the notches or perforations around the periphery of the bubble cap, and loss occasioned by the design of the vapor riser and the shape of the bubble cap is quite small in comparison. The increase in pressure drop, as the height of the overflow weir is raised, is directly dependent on the amount of liquid submergence. For any given depth of submergence and water flow rate there seems to be a particular pressure drop for each tray; if the water rate remains the same, but the depth of submergence is increased, then this added increment of the total pressure drop varies directly with the increase in static depth of liquid submergence.

It was not possible to determine the liquid gradients existing on the tray for various conditions of flow. It seems logical to assume, in the absence of data to the contrary, that for a given rate of air flow, liquid gradients increase as the water rate is increased, and that all liquid gradients should be as low as possible in order to prevent channelling of vapor flow and to insure that each bubble cap contributes equally to the overall efficiency of each fractionating plate.

The method as indicated is applicable for an approximate determination of the heights to which vapor-agitated spray may be carried under a given set of design conditions. This assumes that the data as derived for air and water can be utilized in the computations when the mixture is comprised of two or more volatile hydrocarbons.

(1297) WIND PRESSURES ON SIDES AND TOP OF CYLINDRICAL TANKS.

"An experimental investigation of wind pressures on cylindrical tanks." A. C. Bardin. Stanford University thesis. 1943. (Available by interlibrary loan.)

Tests on vertical cylindrical tank models using water in an open channel as the flowing liquid. Resultant force on side of tank found to act slightly below midpoint. The top uplift force acts at approximately 2/5 D from the windward edge of the roof. The top uplift force is the resultant of a varying pressure distribution, the greatest intensity and the largest fluctuations occurring at the windward edge of the roof. By inspection of distribution patterns it appears that the maximum lifting pressure intensity (occurring at the windward edge of the roof) can be taken as 1.5 to 2.5 times the average.

UNIVERSITY OF WASHINGTON, Hydraulics Laboratory, Seattle, Wash.

FLOW STUDIES FOR TACOMA NARROWS BRIDGE USING BENTONITE SUSPENSION.

Report by Walter F. Hiltner, January 1942. Submitted to Prof. F. B. Farquharson, Director of Model Studies for the Tacoma Narrows Bridge.

Material includes still and Kodachrome moving pictures of flow pattern around cross-section of Tacoma Narrows Bridge as indicated by stream double refraction of Bentonite suspension.

DYNAMIC MODEL OF SEYMOUR NARROWS, BRITISH COLUMBIA.

Report by Walter F. Hiltner, August 1942. Report and model prepared for British Columbia Bridge and Dredging Company, 540 Howe Street, Vancouver, B. C.

Study of effects of currents and waves on drilling barge in Seymour Narrows, with specific danger areas indicated.

HYDRAULIC MODEL OF HELL'S GATE CANYON, PART ONE, CONSTRUCTION AND CORRELATION TO RIVER.

Edward S. Pretious and Walter F. Hiltner, December 30, 1942. Prepared for International Pacific Salmon Fisheries Commission, Seattle, Wash.

Construction of a model of rocky canyon to reproduce flow and indicate effect of proposed remedial measures. Describes methods of modeling, controlling flow and water levels, and adjusting roughness.

UNIVERSITY OF WISCONSIN, Hydraulic Laboratory, Madison, Wis.

Inquiries concerning the following ten projects should be addressed to Dr. Arno T. Lenz, Hydraulic Laboratory, University of Wisconsin, Madison, Wis.

MODEL STUDY OF DISCHARGE CAPACITY OF DU BAY DAM.

(b) Laboratory project in cooperation with Consolidated Water Power and Paper Company, Wisconsin Rapids, Wis.

(c) C. D. Eklund, A. F. Ingersoll, W. W. Warzyn.

(e) Experimental laboratory study as thesis for B.S. degree in Civil Engineering.

(f) To investigate discharge capacity of tainter gates under various conditions of water elevations and gate openings, in order to have some means of measuring the discharge of the river at the dam, since construction of the dam flooded the U. S. Geological Survey gaging station.

(g) Studies were made, using a 1:30 scale model based on plans for the dam. Discharge coefficients were determined for the gates under full and partial opening and with one or more gates open at a time with various head-water and tail-water elevations. The effect of pier contractions was also studied.

(h) Thesis completed in 1942.

(i) Experimental information was obtained on a subject on which there was previous lack of accurate information.

(1300) FLOOD FREQUENCIES OF WISCONSIN RIVERS.

(b) Laboratory project. (c) P. C. Sodermann, J. O. Wagner.

(e) Thesis study for B.S. degree in Civil Engineering.

(f) To study flood-flow records of Wisconsin rivers according to Hazen's probability analysis methods.

(g) Records from 36 Wisconsin gaging stations were analyzed to determine the coefficients of flood, variation, and skew. The records were then grouped for four major sections of the state in order to compare the coefficients from stations within each section. Computed values of the coefficients were compared with the plotted records, and in general the computed curves agree well with the plotted points. The coefficient of flood was essentially constant at 1.3 for the large drainage areas. The coefficient of variation was reasonably constant and varied consistently for all sections. The coefficient of skew was extremely variable, and no consistency was obtained.

(h) Thesis completed in 1942.

OIL FLOW LOSS THROUGH STANDARD PIPE FITTINGS.

(b) Laboratory project. (c) R. A. Woboril.

(e) Experimental laboratory study as thesis for B.S. degree in Civil Engineering.

(f) To study the loss of head with oil flow through standard pipe fittings of 1, 2, and 3-inch nominal diameter.

(g) No. 3 fuel oil was run through 90° and 45° elbows and Tees connected end to side and end to end. Pipe friction losses were subtracted from total losses including fittings to determine the net loss due to the fittings. Losses were expressed in terms of K times velocity head. Values of K were plotted against velocity from 2 to 12 fps and Reynolds number from 2,000 to 6,000. The value of K was found to be independent of velocity and Reynolds number, but varied with size and type of fitting.

(h) Thesis completed in 1943.

HYDROLOGIC INVESTIGATIONS OF AIR MASS MAPS.

(b) Laboratory project. (c) A. H. Glenn, R. W. Wilke, G. A. Williams.

(e) Thesis study for B.S. degree in Civil Engineering.

(f) To correlate published information on U. S. Weather Bureau daily maps with rainfall data from Climatological Data and Daily and Hourly Precipitation Hydrologic Network, Upper Mississippi District.

(g) A comparison of the fronts accompanying storms and the successive hourly positions of the line of maximum intensity of rainfall showed definite time and shape correlation between the two. Typical warm front and cold front storms were studied and the data presented in diagrammatic form. Attempts to correlate mathematically the change in absolute humidity in the air mass and the precipitation caused by it were not very successful because the meteorologic data at hand were not sufficiently complete for this type of analysis.

(h) Thesis by Glenn completed in 1942. Theses by Wilke and Williams completed in 1943.

(i) The material in these two theses was summarized and examples given in a paper, "Comparison of air-mass maps with precipitation-records", published in Trans. American Geophysical Union, 1944. University of Wisconsin Engineering Experiment Station reprint No. 121 is available.

MODEL TESTS OF DU BAY SPILLWAY APRON DESIGN.

(b) Engineering Experiment Station project in cooperation with Consolidated Water Power and Paper Company, Wisconsin Rapids, Wis.

(c) A. T. Lenz.

(e) Experimental project for determination of design of apron structure for Du Bay Dam.

(f) To determine an economical way to dissipate energy of discharge which was cutting a granite rock foundation downstream from the spillway.

(g) Twenty-one apron designs were tested to determine an economical means of preventing erosion below the spillway. The problem was complicated by the fact that the spillway buckets ended at different levels and the rock downstream from the dam was very irregular in cross-section. From the model studies, a construction program was devised to prevent excessive scour while building the apron at levels to conform with existing rock surface conditions.

(h) Report completed in 1944.

(i) The apron has been partially completed as designed and is functioning as intended.

ESTIMATION OF STREAM FLOW FROM ALKALINITY DETERMINATIONS.

(b) The Governor's Committee investigating odor nuisance occurring in the Madison Lakes.

(c) A. T. Lenz and C. N. Sawyer.

(e) Experimental method of determining stream flow.

(f) To provide a method of determining stream flow on small streams tributary to the Madison Lakes in locations where conventional methods were of little value.

(g) By correlating stream flow measurements made on the average of once a week with alkalinity measurements made at the same time, a method was devised for determining the quantitative proportions of hard spring water and soft surface water. From this relation the flows were estimated from alkalinity samples taken once or twice each day.

(h) Project completed in 1944.

(i) "Estimation of stream flow from alkalinity determinations." Arno T. Lenz and Clair N. Sawyer. Trans. American Geophysical Union, Pt. VI: 1005-1010. 1944. University of Wisconsin Engineering Experiment Station reprint No. 122 is available.

CHECKING RUNOFF BY USE OF INFLOW AND OUTFLOW VOLUMES.

(b) The Governor's Committee investigating odor nuisance occurring in the Madison Lakes.

(c) A. T. Lenz.

(e) A theoretical analysis of inflow and outflow volumes to determine average stream flow at an intermediate point between measuring stations.

(f) To check inflow and outflow volumes to Lakes Monona and Waubesa in order to estimate stream flow at Monona outlet.

(g) Flows to Lakes Monona and Waubesa were corrected for inflow from measured and unmeasured tributaries, precipitation on the lakes, additions and reductions due to springs, changes in storage, evaporation, and sewage treatment plant inflow for monthly periods throughout one year. The water balance thus obtained was exceedingly good.

(h) Report completed in 1944.

(i) "Checking runoff by use of inflow and outflow volumes." Arno T. Lenz. Trans. American Geophysical Union, Pt. VI: 1011-1013. 1944. University of Wisconsin Engineering Experiment Station reprint No. 123 is available.

DRAWDOWN STUDIES OF WISCONSIN RIVER RESERVOIRS.

(b) Laboratory project. (c) D. L. Cazier.

(e) Thesis study for B.S. degree in Civil Engineering.

(f) To determine whether, by revised operation, the evaporation loss from the 21 Wisconsin River Valley reservoirs could be reduced.

(g) A study of the reservoir levels and outflow records of 16 major reservoirs was made and evaporation losses computed for each week during the summer evaporation season. The theoretical volume without this evaporation loss was computed and studies were made to determine whether changes in method of control would reduce surface areas during certain seasons when the reservoirs were not full. It was concluded that no important reduction could be made in this evaporation loss.

(h) Thesis completed in 1945.

(i) A brief summary is available in Wisconsin Valley Hydrologic Research Project Report No. 1.

DISCHARGE CAPACITY OF MODEL OF KINGS DAM.

(b) Laboratory project. (c) H. L. Bensel and J. A. Larson.

(e) Experimental laboratory study as thesis for B.S. degree in Civil Engineering.

(f) To determine by model tests the discharge capacity of gates at Kings Dam on the Wisconsin River near Tomahawk, Wis.

(g) A 1:30 scale model was made of the dam section. Discharge coefficients for both orifice and weir flow were determined for gates individually and collectively with and without flow being taken out in proportion to turbine capacity.

(h) Project completed in 1945.

(i) A brief summary is available in Wisconsin Valley Hydrologic Research Project Report No. 2.

UNIT HYDROGRAPH STUDY OF BIG EAU PLEINE RIVER.

(b) Laboratory project. (c) E. J. Beck.

(e) Thesis study for M.S. degree in Civil Engineering.

(f) To determine a six-hour unit hydrograph for the Big Eau Pleine River for use in flood forecasting.

(g) Runoff records for the Big Eau Pleine River at Stratford, Wis., were analyzed and unit hydrographs determined so that estimates could be made of the rate of inflow to the Big Eau Pleine Reservoir. Distribution graphs and mass curves of percent runoff were also computed. A comparison of actual and computed runoff was made for a storm not previously analyzed.

(h) Thesis completed in 1946.

DISCHARGE COEFFICIENTS OF MODEL RECTANGULAR SLUICE GATES.

(b) Laboratory project. (c) Tsuan Hua Feng.

(d) Prof. James G. Woodburn, Hydraulic Laboratory, University of Wisconsin, Madison, Wis.

(e) Experimental laboratory study as thesis for degree of M.S. in Civil Engineering.

(f) To study small-scale models of sluice gates in order to determine the relationship between upstream and downstream water levels, size of gate opening, and discharge.

(g) Sluice gate openings 0.1, 0.2, and 0.3 feet high in flumes 10 inches and 2 feet wide were tested under conditions of free shooting flow downstream and with the downstream water backed up against the gate. Coefficients of discharge were computed, based on difference in water levels upstream and downstream from the gate. With free flow downstream, fairly constant values of discharge coefficients were found, but, with submerged flow, coefficients vary with the difference in water levels and also with the height of headwater. Pitot tube studies were also made of velocity distribution in shooting flow downstream from the gate.

(h) Thesis completed in January 1946.

(i) Because of the small scale of the models, it is desirable to run additional tests on a larger scale when possible. Standard text books and referenoe works in hydraulics give different methods of computing discharge through sluice gates. This study constitutes an initial step towards experimental analysis to correlate various methods which have been proposed.

COMPARATIVE STUDY OF SHAFT OR MORNING GLORY SPILLWAYS.

(b) Laboratory project. (c) José Tejada-Saenz.

(d) Prof. James G. Woodburn, Hydraulic Laboratory, University of Wisconsin, Madison, Wis..

(e) Experimental laboratory study as thesis for M.S. degree in Civil Engineering.

(f) To oompare discharge characteristics in three different designs of vertical spillways for hydroelectric reservoirs.

(g) Models were made using transparent plastic materials and were tested under various heads. Discharge coefficients were determined for various conditions of operation. Entrainment of air and its effect on discharge was studied.

(h) Thesis completed in January 1946.

FLOW OF AIR IN PIPES.

(b) Independent study. (c) A. A. Lemke.

(d) Prof. L. F. Van Hagan, Dept. of Civil Engineering, University of Wisconsin, Madison, Wis.

(e) Thesis for degree of C.E.

(f) (1) To introduoe the new air friction chart, "Flow of air in pipes", prepared by the author for usage in the design of air mains for the activated sludge process of sewage treatment; (2) to expound the theory and development of the chart; (3) to compare the results of this chart with numerous existing charts and formulae; and (4) to explain the application of this chart to the design of air mains, particularly mains for supplying air to Chioago Pump Company diffuser equipment.

(g) In design of pipe systems for air flow considerable discrepancy was found between various charts and formulae, especially in the larger and more expensive pipe sizes. These discrepancies may be due to lack of accurate description of pipe surface, to inadequate information on temperature range, or to non-differentiation between free and compressed air. Some of the diagrams also are not in convenient form to use.

This study develops a new chart based on best available technioal information applying to the range of temperatures and pressures desired and supplemented by a table of oorrection factors to make the chart applicable to various types of pipe surfaces and giving the friotion loss in convenient form. The study shows the selection of pipe sizes based on allowable pressure drop rather than on allowable velocity.

(h) Thesis completed in 1946.

(i) An extensive bibliography is given at the end of the thesis.

WORCESTER POLYTECHNIC INSTITUTE, Alden Hydraulic Laboratory, Woroester, Mass.

PITOMETER LOG CALIBRATION.

(b) Pitometer Log Corporation, 237 Lafayette St., New York, N. Y.

(c) L. C. Neale.

(d) Prof. L. J. Hooper, Woroester Polyteohnio Institute, Worcester, Mass.

(e) Calibration of the individual pitometer logs only.

(f) Rating of various instruments.

(g) Testing the ship logs on the circular current meter rating station in still water operating from 2 to 28 fps.

(h) Completed. (i) These instruments are rated from time to time.

SHIP LOG CALIBRATION.

(b) Bendix Aviation Corp. (c) L. C. Neale.

(d) Prof. L. J. Hooper, Worcester Polytechnic Institute, Worcester, Mass.

(e) Experimental calibration of instruments.

(g) Pitot and impeller types of instruments were rated and effect of various modifications determined.

(h) Test completed.

(i) Tested on current meter rating station from 2 to 28 fps.

SHIP LOG CALIBRATION.

(b) Brown Instrument Company, Philadelphia, Pa. (c) L. C. Neale.

(d) Prof. L. J. Hooper, Worcester Polytechnic Institute, Worcester, Mass.

(e) Experimental calibration of instruments.

(g) Pitot type only and calibration of same. (h) Completed.

(i) Tested on current meter rating station from 2 to 28 fps.

U. S. DEPT. OF AGRICULTURE, FOREST SERVICE, California Forest and Range Experiment Station, Berkeley, Calif.

(1304) MODEL STUDY OF FLOOD AND EROSION CONTROL STRUCTURES FOR MOUNTAIN CHANNELS (FOR LOS ANGELES RIVER FLOOD CONTROL PROJECT OF THE U.S.D.A.).

(b) Forest Service, Region 5, U. S. Dept. of Agriculture.

(d) Regional Forester, Forest Service, San Francisco, Calif.; Prof. M. P. O'Brien, University of California, Berkeley, Calif.; Director, California Forest and Range Experiment Station, Berkeley, Calif.

(e) Laboratory project in cooperation with the University of California and in collaboration with California Forest and Range Experiment Station.

(f) To supplement and verify hydraulic design computations of barriers, scour, and backwater conditions below the barriers, gradients of impounded material, and the effects of other appurtenant structures and replanting operations.

(g) A barrier planned for construction in the channel of the Arroyo Seco was reproduced in model form on a scale of 1:50. Sufficient length of channel upstream and downstream of the structures (from 2000 to 6000 ft) was included to insure proper approach and backwater conditions.

(h) Project completed.

(i) This study included hydraulic tests of a 1:50 scale model of a debris barrier and the contiguous channel. Tests of the barrier included the determination of spillway capacity, the performance of the overflow, the development of a stepped overflow crest, and the operation of the barrier with and without detrital material impounded upstream from the barrier. Tests in the channel cover the problem of scour downstream and deposition upstream from the barrier. Initial tests of deposition upstream from the barrier were based on bedload and rates of transportation as developed in the laboratory. Results of these tests were reasonably verified by data obtained from the first major storm after completion of the prototype structure.

A discussion of these data was presented before the Waterways Division at the Los Angeles (California) Meeting of the A.S.C.E. in July 1943.

Results have been reported as follows: "Model study of Brown Canyon Debris Barrier". Karl J. Bernel and Robert L. Sanks. Proc. A.S.C.E., Vol. 72, No. 5: 613-628. May 1946.

U. S. DEPT. OF COMMERCE, NATIONAL BUREAU OF STANDARDS, Washington, D. C.

SELF-SIPHONAGE OF FIXTURE TRAPS.

(b) Federal Public Housing Authority. (c) J. L. French, E. E. Ferguson, R. S. Wyly.

(d) Chief, National Hydraulic Laboratory, National Bureau of Standards, Washington 25, D. C.

(e) Experimental. To furnish information to code-making authorities.

(f) To investigate the effect of fixture discharge, drain diameter and slope, and type of vent fitting on the permissible distance between a fixture trap and its vent, insofar as this length influences the self-siphonage of the fixture trap harmfully.

(g) Different constant rates of flow were impressed on various trap and drain combinations, and the resulting reduction in trap seal was observed. Variables in the test set-up were the length, diameter, and slope of drain, size and kind of trap, and type of stack fitting. Continuous waste and vent installations were used with long-turn T-Y, short-turn T-Y, and straight T stack fittings. The relation between these variables was determined, and the results were compared with similar tests for typical lavatory installations.

(h) The report on this investigation has been completed.

(496) DETERMINATION OF THE DISCHARGE COEFFICIENTS OF FLOW NOZZLES.

(b) Cooperative research sponsored by the A.S.M.E. Special Research Committee on Fluid Meters.

(c) H. S. Bean, F. C. Morey.

(d) Mr. H. S. Bean, National Bureau of Standards, Washington 25, D. C.

(e) Experimental.

(f) To determine the discharge coefficients of "long radius" flow nozzles; to determine the most satisfactory location for pressure holes; to check, compare, and correlate American and European designs and practices.

(g) A group of approximately 30 flow nozzles ranging from 2 to 16 inch pipe sizes were tested by ten cooperating laboratories using water, oil, air, and steam. Not all sizes were tested by each laboratory, and each used, at most, two of the fluids mentioned. Each nozzle was tested by at least two of the laboratories.

(h) Completed.

(i) "Research on flow nozzles." H. S. Bean. Mech. Eng. 59: 500-502. 1937.

"Determining flow nozzle contours." F. C. Morey. Instruments 10: 157-160. 1937.

"Some results from research on flow nozzles." H. S. Bean and S. R. Beitler. Trans. A.S.M.E. 60: 235-244. 1938.

"Nozzle coefficients for free and submerged discharge." R. G. Folsom. Trans. A.S.M.E. 61: 233-238. 1939.

"Discharge coefficients of long-radius flow nozzles when used with pipe-wall pressure taps." H. S. Bean, S. R. Beitler, and R. E. Sprenkle. Trans. A.S.M.E. 63: 439-445. 1941.

(981) INSTALLATION REQUIREMENTS FOR HEAD METERS.

(b) Cooperative research sponsored by the A.S.M.E. Special Research Committee on Fluid Meters with the National Bureau of Standards.

(c) H. S. Bean, F. C. Morey.

(d) Mr. H. S. Bean, National Bureau of Standards, Washington 25, D. C.

(e) Experimental.

(f) To determine the effect of piping arrangements preceding an orifice meter or flow nozzle upon the indications of the meter.

(g) Tests were made with air, comparing a 4-inch experimental meter with a 4-inch reference orifice meter. The piping preceding the experimental meter could be varied to include different configurations of elbows and valves. Tests were also made with water, determining the rate of flow by direct weighing.

(i) "A review of the installation requirements for head meters." H. S. Bean. Proc. Fourth Annual Appalachian Gas Measurement Short Course. West Virginia University, Morgantown, W. Va. 1941.

"Installation requirements for head meters." H. S. Bean. Heating, Piping, and Air Conditioning 13: 744-746. 1941.

U. S. DEPT. OF THE INTERIOR, BUREAU OF RECLAMATION, Denver, Colo.

Inquiries concerning the following 54 projects should be addressed to The Chief Engineer, Bureau of Reclamation, Denver, Colo.

GRANBY DAM SPILLWAY.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To make a comprehensive study of the spillway for Granby Dam.

(g) A 1:24 scale model of the spillway entrance and channel was used.

(h) Testing has been completed and the report published.

ALL-AMERICAN CANAL SYSTEM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine the behavior of the channel downstream from the Coachella Canal Wash Overchutes and to revise the overchute designs to correct for any unfavorable conditions.

(g) A 1:24 scale model of the canal and a wash overchute was used.

(h) Testing has been completed and the report published.

MODEL WAVE STUDIES FOR CONTRA-COSTA CANAL.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To develop a practicable method of damping the waves produced by pump operation in the finished canal.

(g) A 1:24 scale model of the canal, the gates, and the pumping plant transition was used.

(h) Testing has been completed and the report published.

ALTUS DAM SPILLWAY.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine the hydraulic characteristics of the structure and the recommended apron for the spillway stilling-pool.

(g) A 1:60 scale model of the central portion of the structure and a 1:24 sectional model of the spillway were used.

(h) Testing has been completed and the report published.

OUTLET WORKS OF ANDERSON RANCH DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) Hydraulic model studies to determine the quantity of air required for the outlet works of Anderson Ranch Dam.

(g) A model on a scale of 1:12 representing the center outlet chamber was used.

(h) Testing has been completed and the report published.

BIG SANDY NO. 2 SPILLWAY.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) Determination of the capacity of the spillway, the weir coefficients, the ability of the cross-weir to straighten the flow, and the general hydraulic behavior.

(g) The model of the side-channel spillway was constructed to a scale of 1:30 and included the stilling basin, tailwater control gate, and overflow channel.

(h) Testing has been completed and the report published.

DAVIS DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To perform the required calibrations, to check adequacy of the proposed designs, and to determine the most satisfactory method of operating the spillway and outlet gates.

(g) The model of the outlets was on a scale of 1:50, the model of the channel was on a scale of 1:100, and the recommended spillway bucket profile was evolved from studies on 1:100 and 1:48 scale models.

(h) Testing has been completed and the report published.

THE 58-INCH BALANCED VALVES FOR SHOSHONE DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) Determination of an operating schedule for minimizing damage to needle tips and discharge conduits during the 1943 season.

(g) The model of a 58-inch balanced valve was made on a scale of 1:8.

(h) Testing has been completed and the report published.

RECIRCULATION OF CONDENSER COOLING WATER AT ANTIOCH STEAM ELECTRIC PLANT.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine the extent of recirculation of condenser cooling water.

(g) A model on a scale of 1:100 which included a small portion of the river adjacent to the steam plant site was used.

(h) Testing has been completed and the report published.

FLANGE GASKETS FOR RING-FOLLOWER GATES FOR BOISE STORAGE PROJECT.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To design flange gaskets for the 72-inch ring-follower gates of some material other than rubber because of its scarcity during the war.

(g) A model of the gate and a pump for applying pressure up to 400 pounds per square inch water pressure was used.

(h) Testing has been completed and the report published.

GATE SEAL DESIGNS FOR GRAND COULEE DAM AND SHASTA DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To improve the seal for the Grand Coulee installation and to develop a seal for the gates for the Shasta Dam diversion tunnel.

(g) Two models were used in these tests, a visual sectional seal model and a 10-inch ring-seal model.

(h) Testing has been completed and the report published.

SHASTA POWER PLANT.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To develop a satisfactory seal for the sphere valves for Shasta power plant.

(g) Two hydraulic models were used in which seal assemblies having full-size cross-sections could be tested.

(h) Testing has been completed and the report published.

COASTER GATES.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To check the computed downdraw and to study the effect of the shape of the gate bottom on its magnitude.

(g) Several models were used on different scales.

(h) Testing has been completed and the report published.

VALVES FOR FRIANT DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To develop improved designs of needle and tube valves for Friant Dam.

(g) Models of the valves were made on various scales.

(h) Testing has been completed and the report published.

REDESIGN OF OUTLET VALVES FOR SHOSHONE DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) The redesign of the outlets at Shoshone Dam, to prevent severe damage by cavitation, was evolved from aerodynamic and hydraulic studies.

(g) A model of the 58-inch balanced outlet valves was constructed on a scale of 1:8 (hydraulic) and 1:6 (aerodynamic).

(h) Testing has been completed and the report published.

ROSS DAM SPILLWAYS.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) The hydraulic investigation was made pertaining to the design of the spillways to be used in connection with increasing the height of the Ross Dam.

(g) A model was constructed of the entire arch dam, with top at elevation 1650 to a 1:60 scale.

(h) Testing has been completed and the report published.

LOVELOCK DIVERSION DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine the range of tailwater elevations for hydraulic jumps, and scour that would occur.

(g) For these investigations a 1:16 sectional model was used.

(h) Testing has been completed and the report published.

WASTEWAY ENTRANCES FOR THE FRIANT-KERN CANAL.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To obtain data on the relative merits of two different proposed wasteway designs.

(g) A 1:16 scale model of a section of canal with the wasteway entrance and gate section was used.

(h) Testing has been completed and the report published.

MASON CITY CULVERT INTAKE.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To check the original design for its rated discharge.

(g) A 1:30 scale model of the intake chute, transition, and culvert was used.

(h) Testing has been completed and the report published.

BOULDER DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) Study of the backwater effect expected in the Boulder Dam tailrace due to dredging of the river channel downstream and to the proposed future regulation of Davis Dam Reservoir.

(g) A 1:60 scale hydraulic model of the outlet structures, spillway, and related river channel downstream was used.

(h) Testing has been completed and the report published.

SPILLWAY AND STILLING BASIN FOR CHERRY CREEK DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To verify the hydraulic performance of the designed structure.

(g) Studies with 1:60 hydraulic model.

(h) Testing has been completed and the report published.

ALAMOGORDO OUTLET NEEDLE VALVE.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To investigate the adequacy of proposed changes in the Alamogordo outlet valves to prevent cavitation erosion.

(g) A model having a scale of 1:5, representing a one-eighth sector through the valve and a portion of the outlet conduit, using air as a test medium, was employed.

(h) Testing has been completed and the report published.

HOLLOW-JET VALVE FOR ANDERSON RANCH DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To investigate the feasibility of the proposed design. The investigation included a study of the valve operating mechanism, the pressure distribution on critical portions of the valve, a comprehensive calibration of the design, and a determination of a suitable location for the balancing ports in the needle.

(g) The inlet diameter of the hydraulic models was 6 inches in all cases.

(h) Testing has been completed and the report published.

HIGH-HEAD MERCURY MANOMETER FOR GREEN MOUNTAIN DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To develop a new design for a high-head mercury manometer which would minimize breakage and be free of troublesome mercury leaks.

(g) The new manometer was made of a single piece of plastic tube and a plastic pot.

(h) Testing has been completed and the report published.

ALVA B. ADAMS TUNNEL INLET STRUCTURE, COLORADO-BIG THOMPSON.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine a design for the control structure which would cause a minimum loss of head at a reasonable cost and at the same time comply with the requirements of the law authorizing the project.

(g) In the tests a 1:10 model of the 20 covered bays and the double side-channel spillway having a gate-controlled outlet which was connected to the tunnel portal by a double transition, was used.

(h) Testing has been completed and the report published.

MARSHALL FORD DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) The studies were confined to the ultimate development based on action for the more severe conditions that were expected to exist after completion of the high dam.

(g) The tests were made with four separate models: 1:40.8 sectional model of the initial crest, 1:68 model representing half of the ultimate spillway, 1:40.8 sectional model of the ultimate spillway, and 1:25.5 model of one river outlet.

(h) Testing has been completed and the report published.

WATER REGULATION AT ANDERSON RANCH DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine the capacity and location of the air vents in the penstock.

(g) A 1:40 hydraulic model of the penstock was used.

(h) Testing has been completed and the report published.

JET PUMP FOR KESWICK DAM FISH TRAP.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine the adequacy of the original design.

(g) A 1:10 scale model of the fish trap, distribution chamber, mixing tube, and jet pump were used.

(h) Testing has been completed and the report published.

HOWELL-BUNGER VALVE FOR ROSS DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine the operating characteristics relative to the installation of two of these valves at the downstream end of the lower outlet conduits at Ross Dam.

(g) The model consisted of a 6-inch diameter valve.

(h) Testing has been completed and the report published.

MOON LAKE DAM SPILLWAY AND AUTOMATIC GATES.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To develop a float-controlled gate that would maintain a constant reservoir water-surface elevation for all discharges through the gate.

(g) Analytical studies and tests with scale models.

(h) Testing has been completed and the report published.

GLORY-HOLE SPILLWAYS AT OWYHEE DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To check pressures, discharges, and to ascertain, so far as possible, that no adverse events would occur in the operation of the prototype.

(g) A 1:48 scale model was used which included the topography surrounding the spillway, the spillway and ring-gate control, and the discharge tunnel below the spillway.

(h) Testing has been completed and the report published.

SCOFIELD DAM SPILLWAY AND OUTLET WORKS.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) The objective of the studies was to check the designs of the various features of the spillway, such as the entrance, the crest, the chute, and the stilling-pool, to ensure that they would perform their required functions of passing the predicted flood.

(g) The various features to be studied were constructed to a geometric scale of 1:30 in such a way that revisions could be made quickly and easily.

(h) Testing has been completed and the report published.

SHADOW MOUNTAIN DAM SPILLWAY AND OUTLET.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To verify the adequacy of the spillway design and of the outlet which is incorporated within the spillway.

(g) A model was constructed on a scale of 1:30 which included the inlet to the spillway, the spillway, and section of the river channel below the dam.

(h) Testing has been completed and the report published.

FLUID POLARISCOPE.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Experimental study.

(f) To obtain some method that can be used qualitatively to observe how a moving or a stationary object affects the flow, or quantitatively to calculate the necessary data.

(g) A two-dimensional model usually consists of a thin section of the structure or device to be tested, approximately 1/2-inch to 1-inch thick, mounted between two plates of glass or clear plastic. A plane polarized lens and a quarter wave plate are put on one side and a diffused light source on the other.

(h) Testing has been completed and the report published.

CALIBRATING SINGLE ORIFICE GATES.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) It was desired that the discharge in second-feet be obtained for various combinations of openings and submergence of the gate.

(g) The tests were made on a model of a gate with various combinations of openings and submergence.

(h) Testing has been completed and the report published.

DAVIS DAM SPILLWAY OVERFALL SECTION.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To investigate pressures on the spillway face when the profile of the overflow

section falls inside the trajectory of the sheet of water flowing over it.

(g) The investigation of the pressures on the face of the revised spillway was made by the aid of a model constructed on a 1:50 scale.

(h) Testing has been completed and the report published.

FLAP GATES FOR GILA PUMPING PLANT NO. 1.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine a simple and effective remedy for reducing the shock to the structure when the flap gates were closed.

(g) The model consisted of an 8-inch horizontal propeller pump powered by a 3 hp motor.

(h) Testing has been completed and the report published.

HIGH-HEAD RADIAL GATES FOR DAVIS DAM OUTLETS.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine the characteristics of a radial gate operating under a head of 113 feet.

(g) Tests were made on a 1:30 scale model of the gate with one side of the gate seat transparent so the flow of water through the gate could be observed.

(h) Testing has been completed and the report published.

ALL-AMERICAN CANAL CHECK STATION 60+00.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) The determination of the most economical structure that would serve the requirements and provide ample protection against downstream erosion.

(g) A seven-gate structure set level with the canal bottom and without transitions was constructed on a 1:30 scale.

(h) Testing has been completed and the report published.

ELEPHANT BUTTE DAM SPILLWAY ALTERATIONS.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To show the action of the spillway at large discharges and to determine necessary alterations to make it safe.

(g) A model of the spillway was used, which included a small portion of topography upstream from the spillway as well as the spillway crest section, transition channel, and chute. The model was on a scale of 1:40.

(h) Testing has been completed and the report published.

FRESNO DAM SPILLWAY AND OUTLETS.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To study the proposed designs of the spillway and outlet works, to assure safe and economical operation of these structures.

(g) The 1:60 scale model that was used included the complete spillway, outlet works, reservoir, and downstream river channel.

(h) Testing has been completed and the report published.

RIVER CHANNEL CONDITIONS BELOW BRIDGE CANYON DAM.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To prevent the undermining of the downstream portal structures of the

spillways and outlet tunnels when they are in operation.

(g) The 1:60 scale model that was used included the complete spillways, the seven outlet conduits, the powerplant tailrace, and a 2000-foot reach of the river.

(h) Testing has been completed and the report published.

GRAND COULEE PUMPING PLANT AUTOMATIC FLOATING RADIAL GATES.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To illustrate on a qualitative basis only, the manner in which the gate is operated.

(g) The gate model used had a radius of 24 inches, was 12 inches wide, weighed 22 pounds, was approximately 20 inches high, and was hinged 19.5 inches above the gate sill.

(h) Testing has been completed and the report published.

FLOW CHARACTERISTICS, DISCHARGE, AND PRESSURES RELATIVE TO SUBMERGED DAMS.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) General experimental study.

(f) These tests deal entirely with submerged flow over small dams. They include investigation of the various types of flow encountered, determination of discharge coefficients, and the measurement of water surfaces and pressures on the dam and in the stilling basin.

(g) Two sets of experiments were performed using two different models.

(h) Testing has been completed and the report published.

PILOT KNOB WASTEWAY.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To develop smooth entrance conditions at the right-angle entrance from the main canal to the wasteway channel.

(g) The tests were conducted on a 1:36 wasteway model and a 1:12 model of a single bypass.

(h) Testing has been completed and the report published.

GILA GRAVITY MAIN CANAL WASH OVERCHUTES AND WASTEWAYS.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To study flow conditions in the inlet transition, overchute section over the main canal, the stilling basin, in the overchute inlet, section over the main canal, wasteway inlets, and the stilling basin for separate and concurrent operation of the wasteway and overchute.

(g) Two models were used for the tests. The first on a scale of 1:18 did not include the wasteway. The second on a scale of 1:24 included the wash overchutes and wasteways.

(h) Testing has been completed and the report published.

AIR INJECTION INTO THE FLOW IN THE BOULDER DAM SPILLWAY TUNNELS.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine the effect of air injections into the spillway flow as a shock absorber between the high-velocity water and the tunnel lining, and secondly to determine effect of air injections on sub-atmospheric pressures along the surface of the tunnel invert.

(g) A model of the Arizona spillway tunnel on a scale of 1:60 was used.

(h) Testing has been completed and the report published.

SHASTA DAM COASTER GATE AND HANDLING EQUIPMENT.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To check the computed downpull on gate design for a new shape for the gate bottom.

(g) A 1:17 scale model of the conduit and coaster gate was used for the studies.

(h) Testing has been completed and the report published.

CALIFORNIA WASTEWAY REPAIRS.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To change the original design to prevent further erosion of the left side of the channel downstream from the stilling pool.

(g) A 1:30 scale model of the wasteway and check structures and a section of the canal upstream from the wasteway gates was used.

(h) Testing has been completed and the report published.

ESTES PARK POWER PLANT BUTTERFLY VALVES.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To determine the characteristics of the valve in operation.

(g) The different butterfly valve leaves were tested with air as the fluid medium.

(h) Testing has been completed and the report published.

ANGOSTURA DAM SPILLWAY.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To check the adequacy of the proposed spillway for Angostura Dam for releasing water during floods.

(g) Two models were used: one, a sectional model, was placed in a long flume; the other consisted of the complete spillway and downstream river channel.

(h) Testing has been completed and the report published.

CANYON FERRY DAM SPILLWAY AND RIVER OUTLETS.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To study the proposed design of the spillway and outlet works, and to make necessary changes to assure safe and economical operation of these structures.

(g) A 1:60 model of the overflow section, river outlets, gates, and stilling pool was used.

(h) Testing has been completed and the report published.

STARTING AND STOPPING PUMPS FOR GRANBY DAM PUMPING PLANT.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Specific design investigation.

(f) To study the feasibility of starting the pumps while throttling the flow in the intake lines, to obviate the necessity for purchase of valves for the discharge lines.

(g) An 8-inch vertical pump with a tank reservoir to supply water to the pump was used.

(h) Testing has been completed and the report published.

SACRAMENTO SAN JOAQUIN DELTA, CENTRAL VALLEY, CALIFORNIA.

(b) Bureau of Reclamation. (c) Hydraulic laboratory.

(e) Theoretical and experimental study for project planning and design.

(f) To establish the effects on ocean salinity intrusion of transferring water through the delta channels from the Sacramento River to the San Joaquin river.

(g) A highly distorted scale made with a vertical exaggeration of 1:48, adjusted to give the proper tidal flow, was used to study the mechanics of salinity intrusion. Field studies established that no density current existed and that only true physical diffusion was involved. Solutions of a special blue dye were used to represent salinity and determinations of concentration were made accurately and quickly with a spectrophotometer.

(h) Studies completed.

(i) Report of work covered in Hydraulic Laboratory Reports Nos. 142 and 155.

U. S. DEPT. OF THE INTERIOR, BUREAU OF RECLAMATION, El Paso, Texas.

SILT SURVEYS OF ELEPHANT BUTTE RESERVOIR.

"Silting of reservoirs." Technical Bulletin 524, U. S. Dept. of Agriculture.

Investigations are made periodically and results published when completed.

QUALITY OF WATER STUDY ALONG THE RIO GRANDE.

"Quality of water studies" in the annual bulletin of the International Boundary and Water Commission, El Paso, Texas.

Investigations are made periodically and results published when completed.

U. S. NAVY DEPT., DAVID TAYLOR MODEL BASIN, Washington 7, D. C.

CHARACTERISTICS OF A BOAT-TYPE, LOAD-CARRYING BUOY.

(b) Naval Research Laboratory. (c) P. Eisenberg.

(d) The Director, David Taylor Model Basin, Washington 7, D. C.

(e) Experimental investigations for design purposes.

(f) To develop methods of characterizing a moored load-carrying buoy for fast currents and outline methods of determining mooring line sizes.

(g) Model Basin tests were conducted with models of the NRL Mark 3 Boat-Type buoy under various conditions of loading. Loads were applied by a carefully calibrated depressor. Criteria for overload and stability were developed. Graphical methods were developed for determining mooring line sizes.

(h) Completed and report issued.

(i) "Characteristics of the NRL Mark 3 Boat-Type Buoy and determination of mooring line sizes." P. Eisenberg. TMB Report 550. September 1945.

THE PANAMA CANAL HYDRAULIC LABORATORY, Diablo Heights, Canal Zone.

HYDRAULIC ROUGHNESS COEFFICIENTS FOR LARGE CHANNELS.

(b) Special Engineering Division, Dept. of Operation and Maintenance, The Panama Canal.

(c) Hydraulic Section personnel under supervision of J. S. Meyers.

(d) The Supervising Engineer, Special Engineering Division, Diablo Heights, Canal Zone.

(e) Project is to provide design information for use in Isthmian Canal Studies - 1947. These studies were authorized by Public Law 280, 79th Congress, to investigate means for increasing the security and capacity of the Panama Canal.

(f) To scan available data on hydraulic roughness of large channels, and to select values for use in design of an enlarged canal.

(g) Inquiries were directed to TVA, USBR, and USED, asking for data on large channels. Replies were received citing observations on the Tennessee, Colorado, Mississippi, Columbia, and other large rivers, and for some dredged channels. Observations were made of roughness of the existing canal channel in Gaillard Cut.

(h) Completed.

(i) "Hydraulic roughness coefficients for large channels." Isthmian Canal Studies Memorandum 106, approved December 9, 1946.

(1013) MANIFOLD RESEARCH.

"Lock manifold experiments." Edward Soucek and E. W. Zelnick. Proc. A.S.C.E. October 1944.

(1200) CONTROL OF SURGES IN CANAL.

"Surges in Panama Canal reproduced in model." F. W. Edwards and Edward Soucek. Proc. A.S.C.E. January 1944.

(1311) FORCES FOR OPERATING MITER GATES.

"Hydraulic model investigation of miter gate operation." N. N. Amster. Proc. A.S.C.E. March 1944.

(1201) (1202) (1203) (1204)

Each of these projects is completely covered by individual reports, and significant results from all projects are combined in the report, "Lock model tests - Design 3", by J. C. French and M. J. Webster, August 1942. All reports are in unpublished form (mimeographed, typed, etc.) and a few copies of each are available for loan.

(1201) LOWER APPROACHES TO LOCKS.

"Report on hydraulic model studies for the lower approaches to the third locks". J. M. Groves. August 1941.

In connection with the design of the Third Locks of the Panama Canal, tests were conducted on a hydraulic model of the lower approaches to the Third Locks for the purpose of studying navigation conditions in the lower approaches caused by spilling and by density currents when lock gates separating fresh and salt water are opened.

A 1:60 scale model representing the area of the lock chamber, the width of the lock at the approach, and the downstream channel, was constructed. Various types of outlets and various lengths and degrees of flare of arched and solid approach walls were tested under both steady flow conditions and under conditions simulating actual spilling operations. Velocity distribution in the approaches was determined. Liquids of different density were used for studying density currents.

It was concluded from the tests that symmetrical approaches with walls flared not more than 6 degrees on each side of the center line are most desirable (solid approach walls of equal length and symmetrically flared at 4 degrees with the center line of channel were adopted). Floor outlets discharging between the approach walls or other types of outlets discharging behind the approach walls were satisfactory. Upturned outlets and side-port outlets discharging between the approach walls were unsatisfactory, particularly for one-culvert operation.

(1202) MODEL OF EXISTING LOCK.

"Hydraulic model study of existing locks." E. W. Zelnick. June 1942.

Presented in this report are results of tests conducted on a 1:25 scale model of the west chamber of the existing Pedro Miguel Locks. Forces acting on a vessel and other phenomena occurring during a lockage were determined for various operating conditions. Filling curves obtained from the existing prototype locks are in close agreement with similar model data. A comparison of the results of this study with the results of tests conducted on a model of the Third Locks, Design 1, shows that for the same filling

time the latter gave much smaller forces on the vessel. By opening one leaf of the culvert valve first and then immediately starting the other leaf, the forces on the model vessel were reduced substantially with only a small increase in the filling time.

(1203) MODEL OF PROPOSED LOCK.

"Report on lock hydraulic system - Design 1." J. C. French. April 1942.

Presented in this report are results of tests conducted on a 1:25 scale model of a floor-filling hydraulic system for the Third Locks. The forces on a vessel during a lockage were determined for various opening characteristics of the culvert valves. Tests indicated that excessive longitudinal forces could be eliminated without seriously affecting the filling or emptying time, by increasing the valve period. Under all conditions, lateral distribution of flow in the lock chamber was satisfactory and produced negligible transverse forces. The wall culvert size could not be reduced without causing a substantial increase in the longitudinal force for a comparable filling time. The system contained slightly more lateral area than necessary for the wall culvert size used. Special tests to determine the effect of the magnitude of the motion of the vessel were conducted on another floor-filling system identified as Design 2. The results indicated that the longitudinal forces on the vessel were independent of the moduli of the system within the test limits.

"Report on lock hydraulic system - Design 2." C. Y. Hitchcock, Jr. April 1942.

Presented in this report are results obtained from tests on a 1:25 scale model of a floor-filling hydraulic system for the Third Locks. Forces on a model vessel and filling times during lockage operations were determined with various opening characteristics of the culvert valves for comparison with similar tests on Design 1. Tests indicated that an increase in the number of ports and lateral culverts did not affect substantially the forces on the vessel or the filling time, if the total area of ports and laterals remain unchanged. Excessive longitudinal forces could be eliminated, without seriously affecting the filling time, by increasing the valve period. Under all conditions, lateral distribution of flow in the lock chamber was satisfactory and produced negligible transverse forces.

"Lock model tests - Design 3." J. C. French and M. J. Webster. August 1942.

Presented in this report are the results of tests conducted on a 1:25 scale model lock of the Third Locks Project. The final design of the bottom-filling hydraulic system was tested to determine filling and emptying times, mooring forces, pressures in the system, and culvert valve operation. The tests are compared to those conducted on two preliminary models of the same type of system, and to tests of a model of the existing Panama Canal Locks. Results show that the Third Locks hydraulic system is highly satisfactory. Mooring forces on a loaded ore ship are much less than in the existing locks.

(1204) MODEL OF LOCK CULVERT VALVES.

"Hydraulic model investigation of lock culvert valves." T. E. Murphy. January 1942.

Presented in this report are data from tests conducted on 1:20 scale hydraulic models of two types of radial lock valves, sector and tainter. Both types of valves were tested in tension and in compression. Observations on these models, together with observations on the general lock models, indicated that the tainter valve in tension is most suitable for the Third Locks. Tests also demonstrated that a thin lower lip on the valve was superior to a circular lip. The thin lip reduced the tendency for hydraulic forces to vibrate the valve and decreased the lifting force required to open the valve.

(1204) MODEL OF LOCK INTAKE.

"Hydraulic model investigation of lock culvert intakes." T. E. Murphy. May 1942.

This report presents data from tests of hydraulic models of intakes for the Third Locks culverts. A 1:20 scale model incorporating a portion of the forebay, the intake structure, the upstream valve section, and a short reach of the tunnel was built. Hydraulic characteristics of proposed designs were studied. A satisfactory manifold intake with four ports was developed from the tests.

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U. S. WAR DEPT., CORPS OF ENGINEERS, LOS ANGELES DISTRICT HYDRAULIC LABORATORY, Los Angeles 14, Calif.

(1333) HYDRAULIC MODEL STUDY, SPILLWAY AND OUTLET WORKS FOR SANTA FE FLOOD CONTROL DAM, SAN GABRIEL RIVER, CALIFORNIA.

March 1942. Loan copy may be obtained from U. S. Waterways Experiment Station, Vicksburg, Miss.

(1332) HYDRAULIC MODEL STUDY, LOS ANGELES RIVER CHANNEL IMPROVEMENT, DAYTON AVE. TO FOURTH ST., LOS ANGELES, CALIFORNIA.

December 1943.

HYDRAULIC MODEL STUDY, SPILLWAY FOR SALINAS DAM, SALINAS RIVER, CALIFORNIA.

June 1944. Loan copy may be obtained from U. S. Waterways Experiment Station, Vicksburg, Miss.

HYDRAULIC MODEL STUDY, INTAKE AND BYPASS STRUCTURES, LYTLE AND CAJON CREEKS CHANNEL IMPROVEMENT, SANTA ANA RIVER BASIN, CALIFORNIA.

July 1946. Loan copy may be obtained from U. S. Waterways Experiment Station, Vicksburg, Miss.

U. S. WAR DEPT., CORPS OF ENGINEERS, PORTLAND DISTRICT, Portland, Ore. (Bonneville Hydraulic Laboratory).

Inquiries concerning the following four projects should be addressed to The District Engineer, 628 Pittock Block, Portland 5, Ore.

CONCRETE ABRASION STUDY, BONNEVILLE SPILLWAY DAM, BONNEVILLE, OREGON.

(b) War Dept., Corps of Engineers, Portland District, Portland Ore.

(c) R. B. Cochrane, Head, Hydraulic Design Section, Portland District.

(e) Experimental research.

(f) To determine abrasive effect of silt-laden water on various concrete mixes as part of program initiated to determine cause of erosion on baffles and deck of Bonneville Spillway Dam.

(g) The concrete blocks made of varying concrete mixes were subjected to silt-laden jet 1000 ppm for periods up to 10 days. Angle of attack and velocity of jet were varied. Abrasion determined by survey of eroded area.

(h) Study completed and Bonneville Hydraulic Laboratory Report No. 15-1 issued.

SILT SAMPLING STUDY, BONNEVILLE SPILLWAY DAM, BONNEVILLE, OREGON

(b) War Dept., Corps of Engineers, Portland District, Portland, Ore.

(c) R. B. Cochrane, Head, Hydraulic Design Section, Portland District.

(e) Experimental research.

(f) To determine amount and character of suspended material passing over Bonneville Dam as part of program initiated to determine cause of erosion on baffles and deck of Bonneville Spillway Dam.

(g) Suspended load data from samples taken once or twice a week by a special sampling pipe from jet issuing beneath gate of Bonneville Dam. Fineness determinations, X-ray, and petrographic examination of suspended material made by U. S. National Bureau of Standards.

(h) Study completed and Bonneville Hydraulic Laboratory Report No. 14-1 issued on January 15, 1944.

MODEL STUDY OF 23-FT OUTLET TUNNEL FOR MUD MOUNTAIN DAM, WASHINGTON.

(b) War Dept., Corps of Engineers, Seattle District, Seattle, Wash.

(c) R. B. Cochrane, Head, Hydraulic Design Section, Portland District.

(e) Experimental, design.

(f) To investigate hydraulic design of 23-ft diameter regulating tunnel for Mud Mountain Dam.

(g) A 1:25 scale model of tunnel intake tower, 23-ft diameter tunnel, 8.5-ft diameter penstock, and Howell Bunger regulating valves were used to determine pressure grade lines and general flow data. Safe reservoir operating levels were ascertained so as to avoid strong vortex action in tunnel intake and bore action in 23-ft diameter tunnel.

(h) Model study completed and Bonneville Hydraulic Laboratory Report No. 6-1 issued on July 15, 1942.

(1106) MODEL STUDY OF THE NAVIGATION CHANNEL CONDITION ON THE COLUMBIA RIVER AT BONNEVILLE, OREGON.

(b) War Dept., Corps of Engineers, Portland District, Portland, Ore.

(c) R. B. Cochrane, Head, Hydraulic Design Section, Portland District.

(e) Experimental, design.

(f) To determine the most satisfactory plan for the elimination of undesirable current conditions at the entrance to the downstream approach channel of the Bonneville Navigation Lock.

(g) A concrete fixed bed type of model constructed to a 1:200 scale horizontally and 1:100 scale vertically was constructed of the 5-mile reach of the Columbia River downstream from Bonneville Dam. Flows from 40,000 cfs to 1,000,000 cfs were simulated and especial attention given to the effects of realigning the river banks, enlarging the powerhouse tailrace, and deepening the lock approach channel.

(h) All testing has been completed, and Bonneville Hydraulic Laboratory Report No. 2-1 was issued on January 30, 1942.

U. S. WAR DEPT., CORPS OF ENGINEERS, ST. PAUL DISTRICT, St. Paul 1, Minn.

Information relative to the following seven Hydraulic Laboratory Reports may be obtained from the District Engineer, Corps of Engineers, St. Paul 1, Minn.

(1035) PROTOTYPE LOCK HYDRAULICS TESTS TO VERIFY MODEL EXPERIMENTS.

Hydraulic Laboratory Report No. 46. October 1941.

MISSISSIPPI RIVER, NAVIGATION CONDITIONS IN UPSTREAM APPROACH TO LOCK NO. 10, GUTTENBERG, IOWA.

Hydraulic Laboratory Report No. 47. December 1943.

ST. MARYS RIVER, FILLING AND EMPTYING SYSTEM FOR THE MacARTHUR LOCK, SAULT STE. MARIE, MICHIGAN.

Hydraulic Laboratory Report No. 48. February 1944.

(861) MISSISSIPPI RIVER, FILLING AND EMPTYING SYSTEM FOR NEW LOCK NO. 2, HASTINGS, MINN.

Hydraulic Laboratory Report No. 49. February 1944.

(1037) MISSISSIPPI RIVER, NAVIGATION CONDITIONS IN UPSTREAM APPROACH TO LOCK NO. 6, TREMPEALEAU, WISCONSIN.

Hydraulic Laboratory Report No. 50. December 1944.

(860) MISSISSIPPI RIVER, A SUBMERGIBLE TAINTER LOCK GATE FOR ST. ANTHONY FALLS LOWER LOCK, MINNEAPOLIS, MINNESOTA.

Hydraulic Laboratory Report No. 51. August 1945.

(109) LABORATORY TESTS ON MODELS OF LOCK HYDRAULIC SYSTEMS.

Hydraulic Laboratory Report No. 52. June 1946.

U. S. WAR DEPT., CORPS OF ENGINEERS, U. S. WATERWAYS EXPERIMENT STATION, Vicksburg, Miss.

Inquiries concerning the following twenty-three projects should be addressed to The Director, U. S. Waterways Experiment Station, P. O. Box 631, Vicksburg, Miss.

MODEL STUDY OF SPILLWAY AND STILLING BASIN, ALLATOONA DAM, ETOWAH RIVER, GEORGIA.

(b) The District Engineer, U. S. Engineer Office, Mobile, Ala.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of spillway and stilling basin.

(f) To analyze the hydraulic characteristics of the spillway and stilling basin, and to develop means of correcting any uneconomic, unsafe, or otherwise undesirable conditions which may exist in the proposed design.

(g) Allatoona Reservoir, to be located on the Etowah River about 48 miles upstream from the city of Rome, Georgia, will provide flood control in the Alabama-Coosa River system. Provisions will also be made for the generation of power. The dam will be a concrete-gravity structure. Flow regulation will be afforded by manipulation of 11 gates and by operation of the turbines. The spillway is designed to pass a flow of 297,000 cfs under a head of 33.8 feet. The 1:50-scale model reproduced about 600 feet of approach channel, the dam proper, the spillway, the powerhouse, and about 4000 feet of the exit channel.

(h) Study completed. Final report: Tech. Memo. No. 214-1, "Model study of spillway, Allatoona Dam, Etowah River, Georgia", available on loan.

MODEL STUDY OF SPILLWAY AND STILLING BASIN, BERLIN DAM, MAHONING RIVER, OHIO.

(b) The District Engineer, U. S. Engineer Office, Pittsburgh, Pa.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To develop an economical stilling-basin design.

(g) Berlin Dam, to be located on the Mahoning River 18 miles west of Youngstown, Ohio, will provide flood control and low-water regulation in the Mahoning River valley. The dam will consist essentially of a concrete-gravity spillway section, designed to discharge 79,000 cfs, flanked by an earth embankment section. The central portion of the spillway, with crest elevation at 1014, will be controlled by four tainter crest gates 30 feet long by 18 feet high. The remainder of the spillway will be uncontrolled and will consist of twelve 30-ft bays with crest at elevation 1032. Normal flow will be regulated by three 36-inch diameter conduits through the spillway section. The 1:48-scale model reproduced 720 ft of approach channel, the spillway, and 1300 ft of the exit channel. The topographic features of the approach area and the spillway were molded of cement mortar. The exit area downstream from the spillway had a movable bed of sand to permit qualitative study of erosion under various operating schedules. The sand bed was capped with a cement crust for stability during velocity observations.

(h) Study completed. Final report: Tech. Memo. No. 193-1, "Model study of spillway for the Berlin Dam, Mahoning River, Ohio", available on loan.

MODEL STUDY OF POWER PENSTOCKS, BLUESTONE DAM, NEW RIVER, WEST VIRGINIA.

(b) The District Engineer, U. S. Engineer Office, Huntington, West Virginia.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for checking the design of power penstocks.

(f) To determine the degree to which any turbulence created by the intake and penstock design may be carried into the scroll case and thus affect the performance of the turbines. Evaluation of the probable effect of turbulence in the Bluestone Dam penstocks will be based on comparative data from a model of the penstocks of Norris Dam which are known to function satisfactorily.

(g) Bluestone Dam, on New River near Hinton, West Virginia, will be a flood-control and hydroelectric power project. The dam is to be provided with six penstocks for connection to the powerhouse turbines. It is proposed to install two 30,000-kw units at the present time, with provisions for

eventual installation of four additional units of the same size. The penstocks leading to the turbine scroll case of each unit will be 19 ft in diameter and about 95 ft in length. The present design incorporates one 63-ft radius vertical bend in the penstocks proper. Two models were involved in this study: (1) a 1:36-scale model reproducing the trash bars, the intake, penstock, and scroll case of one of the power units for the Bluestone Dam, and (2) a 1:36-scale model of the same elements for one of the power units for Norris Dam. Practically all of the structures were constructed of transparent pyralin for observation of flow conditions.

(h) Study completed. Final report: Tech. Memo. No. 220-1, "Model study of power penstocks, Bluestone Dam, New River, West Virginia", available on loan.

MODEL STUDY OF SLUICE OUTLET, BLUESTONE DAM, NEW RIVER, WEST VIRGINIA.

(b) The District Engineer, U. S. Engineer Office, Huntington, West Virginia.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for sluice outlet design.

(f) To develop a satisfactory sluice outlet portal with the deflector inside the face of the spillway.

(g) Located on New River near Hinton, West Virginia, the Bluestone project is one of the flood-control reservoirs for the Ohio River Valley. The dam is designed as a straight concrete gravity structure with an overall length of 2060 ft, consisting of 790 ft of spillway section, 310 ft of intake structure for future power installation, and 960 ft of nonoverflow and abutment sections. Flow over the spillway will be controlled by 21 gates each 31 ft high and 30 ft wide. Flood-control outlets consist of sixteen 5.67-ft by 10-ft rectangular sluices through the base of the spillway. A 1:15-scale model reproduced a complete sluice, a portion of the downstream face of the spillway, and the stilling basin.

(h) Study completed. Final Report: Tech. Memo. No. 2-227, "Model study of sluice outlet for Bluestone Dam, New River, West Virginia", available on loan.

(1337) MODEL STUDIES OF SPILLWAY AND BUCKET, CENTER HILL DAM, CANEY FORK RIVER, TENNESSEE.

(b) The District Engineer, U. S. Engineer Office, Nashville, Tenn.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of spillway and bucket.

(f) To analyze the hydraulic characteristics of the spillway and bucket, and to develop means of correcting any uneconomic, unsafe, or otherwise undesirable conditions which may exist in the proposed design.

(g) Center Hill Reservoir, to be located on the Caney Fork River, is a unit of the flood-control plan for the Ohio and Mississippi River valleys. Provisions will also be made for the generation of power. Flow regulation will be afforded by six 6-ft by 4-ft rectangular sluices through the spillway. Eight 37-ft by 50-ft tainter gates surmounting the spillway will be used to control extreme floods. The spillway is designed to pass a flow of 457,000 cfs under a head of 43 ft. Two models were involved in this study: (a) a 1:40-scale section model of a central bay of the spillway with two adjacent half bays including the bucket and portions of the approach and exit channels; and (b) a 1:100-scale comprehensive model of the entire problem area.

(h) Studies completed. Final report: Tech. Memo. No. 202-1, "Model studies of spillway and bucket, Center Hill Dam, Caney Fork River, Tennessee", available on loan.

(1239) MODEL STUDY OF SPILLWAY AND INTEGRAL SLUICES, CANTON DAM, NORTH CANADIAN RIVER, OKLAHOMA.

(b) The District Engineer, U. S. Engineer Office, Tulsa, Okla.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

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(f) (a) To analyze the hydraulic characteristics of the Canton Spillway, the integral sluices, and the spillway approach and exit channels, as designed; (b) to test certain proposed alterations in the design of these elements; and (c) to obtain the best flow conditions possible for the most economical and desirable design that can be developed.

(g) Canton Reservoir, to be located on the North Canadian River near Canton, Okla., will provide flood control in the North Canadian and Arkansas River valleys. A chute-type spillway adjacent to the right abutment of the earth-fill dam is designed to pass 342,000 cfs under a head of 29 ft and will be surmounted by sixteen 40-ft-wide by 25-ft-high tainter gates to control extreme floods. Normal flow regulation will be afforded by three 12-ft by 7-ft conduits through the center portion of the spillway. Three models were involved in this study: (1) A 1:24-scale section model reproduced two interior bays of the spillway, without sluices or tainter gates, and 450 ft of the approach channel. (2) A 1:27-scale section model of two interior bays of the spillway included a short portion of the approach and exit channels, one sluice, two crest gates, and a section of the stilling basin. The center crest-gate pier, through which the sluice passes, and the sluice were molded of transparent pyralin. (3) A 1:100-scale comprehensive model of a portion of the dam, incorporating changes in design indicated by the first two studies, was used for a general investigation of the control structures of the dam.

(h) Study completed. Final report: Tech. Memo, No. 190-1, "Model study of the spillway and integral sluices for the Canton Dam, North Canadian River, Oklahoma", available on loan.

MODEL STUDY OF REGULATING SLUICES, DALE HOLLOW DAM, OBEY RIVER, TENNESSEE.

(b) The District Engineer, U. S. Engineer Office, Nashville, Tenn.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) (a) To analyze the hydraulic characteristics of the sluices which have a sharp downward bend, and (b) to determine whether these bends will give rise to cavitation on the bottom and sides of the sluices.

(g) Dale Hollow Reservoir, to be located on the Obey River, is a unit of the flood-control plan for the Ohio and Mississippi River valleys. Provisions will also be made for the generation of power. Flow regulation will be afforded by four 6-ft by 4-ft rectangular sluices through the spillway. Six 60-ft by 12-ft tainter gates surmounting the spillway will be used to control extreme floods. The spillway is designed to pass a flow of 159,000 cfs under a head of 24 ft. The capacity of the four sluices will be about 6200 cfs with reservoir at spillway crest. A 1:15-scale model was constructed of one pair of flood-control sluices, and reproduced a short section of the approach channel, the sluices and sluice gates, and a portion of the spillway face and bucket downstream from the sluices.

(h) Study completed. Final report: Tech. Memo. No. 197-1, "Model study of regulating sluices for Dale Hollow Dam, Obey River, Tennessee", available on loan.

MODEL STUDY OF STILLING BASIN, DELAWARE DAM, OLENTANGY RIVER, OHIO.

(b) The District Engineer, U. S. Engineer Office, Cincinnati, Ohio.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To examine the hydraulic performance of the stilling basin of the Delaware Dam as designed.

(g) The Delaware Dam, to be constructed on the Olentangy River, about 6 miles above the city of Delaware and about 164 miles above the Scioto River at Portsmouth, Ohio, will provide flood protection in the Scioto River basin and is part of the comprehensive plan for the control of floods on the Ohio River. The dam will consist of a gravity-concrete spillway section with gravity-concrete nonoverflow abutment sections flanked by rolled-fill embankments terminating in low dikes on the abutments. The spillway, designed to discharge 96,000 cfs under a head of 28 ft, will contain six crest gates, each 32 ft long by 25 ft high. Normal flow will be regulated by conduits

through the spillway section. An existing 1:60 undistorted-scale model of the Conemaugh Dam was used for the tests. The height of the Delaware Dam was made to agree with the Conemaugh model by assuming a model-scale ratio of 1:31. Accordingly, the details of the Delaware stilling basin were reproduced on a 1:31-scale and installed at the toe of the Conemaugh overflow section.

(h) Study completed. Final report: Tech. Memo. No. 205-1, "Model study of stilling basin, Delaware Dam, Olentangy River, Ohio", available on loan.

(1336) MODEL STUDY OF SPILLWAY AND STILLING BASIN, DEWEY DAM, JOHNS CREEK, KENTUCKY.

(b) The District Engineer, U. S. Engineer Office, Huntington, West Virginia.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) (a) To determine the protective measures necessary to insure the safety of the dam and appurtenant structures; and (b) to investigate and design an efficient spillway that will pass the design discharge satisfactorily through the spillway and stilling-basin area.

(g) Dewey Reservoir, to be located on Johns Creek, 5.4 miles above its confluence with Levisa Fork of Big Sandy River, will be used to reduce flood heights in the Big Sandy and Ohio River valleys. The rolled-fill earth dam will have an uncontrolled chute-type spillway designed to discharge 22,000 cfs under a head of 25 ft. Normal flows will be regulated by outlet works (maximum capacity 5000 cfs) consisting of a three-gated intake structure, a 500-ft horseshoe-shaped conduit, and a stilling basin. The 1:50-scale model reproduced 1400 ft of approach channel, the dam proper, the spillway, the outlet works, and 1000 ft of the exit channel. The topographic features of the approach area, the dam, and the spillway were molded of cement mortar. The outlet structures were reproduced schematically of cement mortar, wood, and sheet metal. The exit area downstream from the dam had a movable bed of sand to permit qualitative study of erosion under various operating schedules. The sand bed was capped with a cement crust for stability during velocity observations.

(h) Study completed. Final report: Tech. Memo. No. 191-1, "Model study of spillway for Dewey Dam, Johns Creek, Kentucky", available on loan.

(1225) MODEL STUDY OF SPILLWAY AND EXIT CHANNEL, EXPERIMENT STATION DAM, DURDEN CREEK, MISSISSIPPI.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for information.

(f) To verify computed flow lines through the existing channel and to determine benefits to be gained by various proposed improvements; also to obtain data for use in connection with the hydrological survey of the Experiment Station lake drainage area (see Project No. 224, p. 76, "Hydrological Research Project, Experiment Station Lake Watershed").

(g) The Experiment Station lake dam is an earth embankment 450 ft long by 20 ft high. Normal flow from the lake is controlled by a 7-ft diameter conduit through the dam having a maximum capacity of 550 cfs. Flood flows pass over a chute-type spillway (crest length 120 ft). The project provides for increasing the capacity of the spillway and improving that reach of Durden Creek (the common exit channel for both spillway and conduit) which passes through the Station grounds in order to eliminate the danger of damages from flash floods. The 1:25-scale model includes 240 ft of the approach to the spillway, the spillway, the stilling basin, conduit exit, and 890 ft of the exit channel. The model was molded of concrete and had the proper surface roughness. However, provisions were made for installing a movable-bed section below the spillway to study the effects of erosion.

(h) Study completed. Letter report, "Proposed improvements of the Durden Creek channel at the U. S. Waterways Experiment Station", July 11, 1944, available on loan.

FIELD PRESSURE MEASUREMENTS, FORT PECK POWER PLANT PENSTOCKS, FORT PECK, MONTANA.

(b) The District Engineer, U. S. Engineer Office, Fort Peck, Mont.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for information.

(f) To determine the amplitude of pressure waves caused by different rates of closure of the penstock gates so that a pressure equal to that of 300 ft of water will not be exceeded.

(g) The present installation at Fort Peck Dam consists of one 35,000-kw unit installed in penstock 1. Ultimately there will be an installed capacity of 105,000-kw consisting of three 35,000-kw units. The apparatus consisted of five Experiment Station hydrostatic pressure cells with a range of 0 to 150 psi. These cells were installed in short 4-inch pipe nipples which were welded into the walls of the power tunnel. The cells were connected to a suitable amplifier and oscillograph for recording pressures. The amplifier, which was developed at the Experiment Station, contained four channels so that the pressures from four cells could be taken simultaneously. Each channel contained a decade resistance which was used to calibrate the cells before each test was made. The cells were connected through this amplifier to four supersensitive elements of a Westinghouse-type PA oscillograph.

(h) Study completed. Final report: Tech. Memo. No. 206-1, "Field pressure measurements, Fort Peck Powerhouse Penstock, Fort Peck, Montana", available on loan.

MODEL STUDY OF STILLING BASIN, NARROWS DAM, LITTLE MISSOURI RIVER, ARKANSAS.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To examine the hydraulic performance of the stilling basin as designed and to investigate the existence of cavitation pressures on baffle piers in the stilling basin.

(g) Narrows Dam, to be located on the Little Missouri River, a tributary of the Ouachita River, approximately 11.4 miles upstream from Murfreesboro in Pike County, Ark., will be a dual-purpose flood-control and hydroelectric power dam. The dam will consist of a concrete-gravity structure containing a centrally located uncontrolled overflow spillway section (designed to discharge 41,000 cfs), powerhouse intake, and adjacent nonoverflow sections. Normal flow will be regulated by two 8.5-ft diameter conduits. In order to study the performance of the Narrows Dam stilling basin as quickly and efficiently as possible, an existing 1:24-scale section model of the Conemaugh Dam was utilized for the tests of the Narrows Dam stilling basin. The 100.5-ft drop from crest to basin of the Conemaugh Dam on a 1:24-scale model was equivalent to the 173-ft drop from crest to basin of the Narrows Dam on a 1:41.4-scale. Accordingly, the details of the Narrows Dam stilling basin were reproduced on a 1:41.4 scale and installed at the toe of the Conemaugh overflow section; no attempt to alter the crest shape was made. The model basin width of the Conemaugh Dam was equivalent to a 124-ft section of the Narrows Dam.

(h) Study completed. Final report: Tech. Memo. No. 209-1, "Model study of stilling basin, Narrows Dam, Little Missouri River, Arkansas", available on loan.

MODEL STUDY OF POWER PENSTOCKS, NORFOLK DAM, NORTH FORK RIVER, ARKANSAS.

(b) The District Engineer, U. S. Engineer Office, Little Rock, Ark.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To determine the degree to which any turbulence created by the intake and penstock design may be carried into the scroll case and thus affect the performance of the turbines. Evaluation of the probable effect of turbulence in the Norfork Dam penstocks will be based on comparative data from a model of the penstocks of Norris Dam which are known to function satisfactorily.

(g) Norfork Dam, on North Fork River about 105 miles north of Little Rock, Ark., will be a flood-control and hydroelectric power project. The dam will have four penstock intakes with two complete penstocks installed initially. The powerhouse will be constructed for two 35,000-kw units with only one unit installed at this time. The design of the plant provides for an ultimate capacity of four units. Each penstock will be 18-ft in diameter and about 164-ft long, and will include a vertical bend with a radius of 75-ft. The 1:36-scale model reproduced the trash bars, the intake, penstock, and scroll case of one of the power units for the Norfork Dam. Practically all of the structures were constructed of transparent pyralin for observation of flow conditions.

(h) Study completed. Final report: Tech. Memo. No. 218-1, "Model study of Power Penstocks, Norfork Dam, North Fork River, Arkansas", available on loan.

MODEL STUDY OF FLOOD PROTECTION PROJECT, PRATTVILLE, ALABAMA.

(b) The District Engineer, U. S. Engineer Office, Mobile, Ala.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To check computed flow lines through the improved channel downstream from the dam, to determine the discharge capacity of the revised spillway, and to measure velocities below the spillway and in the channel downstream.

(g) Prattville, Ala., is located on Autauga Creek about 6.5 miles above its junction with the Alabama River. To control floods at Prattville, the existing dam is to be improved by lowering a portion of the crest, thereby increasing the spillway capacity; a portion of the channel downstream will be paved; and concrete retaining walls adjacent to and above the paved section will be constructed to prevent the undermining of certain buildings. The 1:36-scale model reproduced about 400 ft of the approach area, the dam, and about 1200 ft of improved channel downstream. A sufficient amount of overbank area was included in the model to insure correct results.

(h) Study completed. Final report: Tech. Memo. No. 200-1, "Model study of flood protection project, Prattville, Alabama", available on loan.

(1340) MODEL STUDY OF SPILLWAY AND REGULATING SLUICES, WOLF CREEK DAM, CUMBERLAND RIVER, KENTUCKY.

(b) The District Engineer, U. S. Engineer Office, Nashville, Tenn.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) (a) To analyze the hydraulic characteristics of the Wolf Creek spillway and sluice outlets; and (b) to develop means of correcting any uneconomic, unsafe, or otherwise undesirable conditions which may exist in the proposed design.

(g) Wolf Creek Reservoir, to be located on the Cumberland River, is a unit of the flood-control plan for the Ohio and Mississippi River valleys. Provisions will also be made for the generation of power. The dam will be a combined rolled-fill and concrete-gravity structure. Flow regulation will be afforded by six 6-ft by 4-ft sluices through the spillway section. Ten 37-ft by 50-ft tainter gates surmounting the spillway will be used to control extreme floods. The spillway is designed to pass a flow of 535,000 cfs under a head of 44 ft. Three models were involved in this study: (a) a 1:40-scale section model of one central bay of the spillway with two adjacent half bays, a portion of the approach channel, the bucket, two pairs of sluices, and a portion of the exit channel; (b) a 1:15-scale model of one pair of flood-control sluices, which reproduced a short section of the approach channel, the sluices and sluice gates, and a portion of the spillway face and bucket downstream from the sluices; and (c) a 1:100-scale comprehensive model of the entire problem area, which included about 1200-ft and 2900-ft of the channel above and below the dam, respectively, spillway and sluices, bucket, power intake, and conduits, and about 600-ft of the earth embankment.

(h) Study completed. Final report: Tech. Memo. No. 201-1, "Model study of spillway and regulating sluices for Wolf Creek Dam, Cumberland River, Kentucky", available on loan.

MODEL STUDY OF SHOALING ELIMINATION IN BASIN OF NAVY DEPARTMENT FLOATING DRY DOCK YFD-15 AT CHARLESTON, SOUTH CAROLINA

(b) The Chief, Bureau of Yards and Docks, U. S. Navy Dept., Washington, D. C.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for general information.

(f) To test the effectiveness of various proposed plans for solving the troublesome shoaling problem in the Navy Department's floating dry dock basin at Charleston, S. C.

(g) An analysis of the results of monthly shoaling surveys in the dry dock basin indicates that the basin shoals at an average rate of about 3 ft per month. Frequent removal of the dry dock and dredging of the basin is therefore necessary to maintain sufficient operating depth for the dry dock. Such maintenance dredging is not only a costly operation, but it also requires that the dry dock remain out of operation for a considerable time for each dredging of the basin. It is believed that there are two major causes of the rapid shoaling in the basin. The velocities of the silt-laden ebb and flood currents of the river are reduced by the closely spaced piles of the two piers flanking the basin, with the result that a loss of silt load occurs as the flow passes through the pile structures and into the basin. A further loss of velocity, with a corresponding loss of silt load, occurs within the basin due to the much greater hydraulic cross-sectional area within the basin as compared with the adjacent areas on either side of the basin. The model was constructed to an undistorted linear scale ratio, model-to-prototype, of 1:40. The prototype area reproduced consisted of a section of the Cooper River adjacent to the Charleston waterfront 1000 ft in width and extending 1000 ft upstream and 1000 ft downstream from the floating dry dock. All piers and other structures along the water front were reproduced to scale in the model. The bed of the model was molded in concrete to the configurations of the prototype survey of 31 March to 18 April 1944. The model was equipped with a reversible-flow circulating system by means of which constant ebb or flood flow could be reproduced. Provisions were made at either end of the model for the introduction of gilsonite, a light-weight shoaling material with a specific gravity of 1.035 which was used in simulation of the prototype silt.

(h) Study completed. Final report: Tech. Memo. No. 219-1, "Model study of shoaling elimination in basin of Navy Department floating dry dock YFD-15 at Charleston, South Carolina", available on loan.

(415) MODEL STUDY OF FLOW LINES FOR REVIEW OF MISSISSIPPI RIVER PROJECT.

(b) The President, Mississippi River Commission, Vicksburg, Miss.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design of flood control project.

(f) To determine flow lines along the Mississippi River (between Helena, Ark., and Donaldsonville, La.) for project designed flows on approximate 1939 channel conditions.

(g) Study of flood-control plans for the Lower Mississippi River. The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:2000; vertical dimensions, 1:100. Reproduced in the model are the main channel of the Mississippi River from Helena, Ark. (300 miles below Cairo, Ill.) to Donaldsonville, La. (900 miles below Cairo, Ill.); the entire Atchafalaya Basin as far south as the Gulf of Mexico; and the backwater areas of the Arkansas, White, Yazoo, Ouachita, and Red Rivers.

(h) Study completed. Letter report submitted during the conduct of testing.

(1226) MODEL STUDY OF FLOOD-CONTROL PROJECT, MILL CREEK, CINCINNATI, OHIO.

(b) The District Engineer, U. S. Engineer Office, Cincinnati, Ohio.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for design.

(f) To study the hydraulic performance of structures proposed for the protection of Cincinnati, Ohio, from Ohio River floods.

(g) The Cincinnati Local Protection Project (Barrier Dam and Unit 4) involves the

proposed levee and flood wall to be constructed across Mill Creek to prevent Ohio River flood waters from backing up into the creek valley, and a barrier dam and pumping station for the purpose of discharging the flood waters of Mill Creek during high water in the Ohio River. Two fixed-bed models were used in the study: (1) A 1:50-scale model reproduced about 3100 ft of Mill Creek (up to the 490-ft contour) from its confluence with the Ohio River to a point 100 ft north of Gest Street bridge. Although the model was built of concrete, it was so constructed that alterations could be made to reproduce either the existing channel conditions or conditions with the barrier dam in place. Investigations were made for all discharges up to a maximum of 76,000 cfs. (2) A 1:25-scale model reproduced Mill Creek in the vicinity of the proposed barrier dam and served to determine the flow conditions (velocity distributions, existence of eddies, etc.) in the pumphouse forebay and exit channel. The model was so constructed that changes in design of the barrier dam and pumphouse could be easily introduced. Investigations were made with discharges up to 18,000 cfs.

(h) Study completed. Final report: Tech. Memo. No. 188-1, "Model study of Mill Creek flood control project, Cincinnati, Ohio", available on loan.

MODEL STUDY OF NAVIGATION IMPROVEMENTS, ST. MARYS RIVER, MICHIGAN.

(b) The District Engineer, U. S. Engineer Office, Detroit, Mich.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for navigation improvements.

(f) To determine the most satisfactory remedial measure to be taken at the inlet to the Michigan Northern Power Company Canal for reducing cross-currents and navigation hazards in the westerly approach to the South Canal.

(g) St. Marys River connects Lake Superior and Lake Huron, and is an important link in the Great Lakes navigation system. At Sault Ste. Marie, Mich., the navigation channel by-passes St. Marys Falls through two canal-and-lock systems, the Canadian Canal and the North and South American Canals. Just above the westerly approach to the South Canal, the inlet to the Michigan Northern Power Canal opens into the river and creates cross-currents hazardous to boats which have slowed down to enter South Canal. Several means of eliminating this condition are being investigated. The model is of the fixed-bed type with scale ratios: horizontal dimensions, 1:150; vertical dimensions, 1:50. Reproduced in the model is a 2-mile reach of the St. Marys River including portions of the Michigan Power Company Canal, the North and South American Canals, the Canadian Canal, the Canadian Power Canal, the U. S. Power Canal, and the regulating works above St. Marys Falls.

(h) Study completed. Final report: Tech. Memo. No. 208-1, "Model study of plans for improvement of navigation at the upstream entrance to St. Marys Falls Canal, Michigan", available on loan.

(1143) MODEL STUDY FOR IMPROVEMENT OF NAVIGABLE CHANNEL, ABSECON INLET, ATLANTIC CITY, NEW JERSEY.

(b) The District Engineer, U. S. Engineer Office, Philadelphia, Pa.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for channel improvements.

(f) To determine the effects of several proposed jetty locations at the mouth of Absecon Inlet, with especial attention to their efficacy in maintaining a ship channel and their effect on the beaches at Atlantic City.

(g) Absecon Inlet is located between Brigantine Beach on the northeast and Atlantic City Beach on the southwest, and forms the entrance to the harbor at Atlantic City. The project provides for obtaining and maintaining by dredging an entrance channel 20 ft deep and 400 ft wide at mlw. It also is provided that, should the maintenance of the channel at any time have a deleterious effect on Atlantic City Beach, work upon the improvement can cease, it being understood that the interests of the beach are paramount, to those of the inlet. The model was of the movable-bed type. The movable-bed reach extended from Ventnor, N. J., to a point on Brigantine Beach 22,000 ft northeast of Absecon Inlet. Scale ratios were: horizontal dimensions, 1:500; vertical dimensions, 1:100. Provisions were made for reproducing waves from any direction between south and east, tides of any type,

and littoral currents either up or down the beach.

(h) Study completed. Final report: Tech. Memo. No. 204-1, "Model study of plans for elimination of shoaling in Absecon Inlet, New Jersey", available on loan.

MODEL STUDY OF AGATE BAY HARBOR, MINNESOTA.

(b) The District Engineer, U. S. Engineer Office, Duluth, Minn.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for harbor improvement.

(f) (a) To study wave action within the harbor in order to determine the most advantageous location for new breakwaters to protect the harbor from storm waves; and (b) to determine the effect of extending eastward the existing dredged maneuver area within the harbor.

(g) Agate Bay Harbor, located on Lake Superior, 26 miles above Duluth, Minn., is an important iron ore shipping port. Due to the small size of the harbor, the extended ore docks, and the increased size of the ore vessels, considerable difficulty has been experienced in maneuvering vessels within the harbor. In order to provide more maneuver area and to reduce wave action during storms, several plans have been proposed for dredging a larger area in the harbor and relocating existing breakwaters. The model was of the fixed-bed type constructed to the linear-scale ratio, model to prototype, of 1:150. Reproduced in the model were the entire harbor, adjacent shore lines, all docks in the harbor, the two breakwaters, and the adjoining area of Lake Superior to the 90-ft depth contour. A movable wave machine of the plunger type was used to generate waves of the desired dimensions and from the desired directions. Improved electrical wave-height measuring and recording devices were used to obtain wave heights at critical points in the model harbor, and a scale replica of a typical ore vessel was used to study the effect of wave action and currents on vessels moored at the ore docks.

(h) Study completed. Final report: Tech. Memo. No. 203-1, "Model study of Agate Bay Harbor, Minnesota", available on loan.

(1335) MODEL STUDY OF SALT WATER INTRUSION, LOWER MISSISSIPPI RIVER, LOUISIANA.

(b) The District Engineer, U. S. Engineer Office, New Orleans, La.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for information.

(f) (a) To study the action of the salt water wedge; and (b) to investigate plans for eliminating or delaying this intrusion of salt water from the Gulf of Mexico into the lower reaches of the Mississippi River.

(g) The project consisted of a model study of proposed means for stopping or delaying the intrusion of salt water from the Gulf of Mexico into the Lower Mississippi River. This intrusion is effected during periods of low-water flow in the river, and at times it results in contamination of the water supply of New Orleans. The model was of the fixed-bed type with scale ratios: length 1:1000; width, 1:350; and depth, 1:100. Reproduced were 40 miles of that reach of the Mississippi River between New Orleans and the Head of Passes. Provision was made for the introduction of fresh water at the upper end of the model (to simulate any desired prototype hydrograph), and the requisite salt water inflow at the lower end of the model. Potassium permanganate was mixed with the saline solution, thus making it possible to observe visually the advance of the salt water wedge. The elevations of the wedge interface were determined by the use of an electrical salinity meter which located the position of the interface at points downstream from the head of the wedge.

(h) Study completed. Preliminary report, "Model study of salt water intrusion, Lower Mississippi River", May 8, 1942. available on loan.

(1231) MODEL STUDY OF PLANS FOR ELIMINATION OF SHOALING, WILMINGTON HARBOR, CHRISTINA RIVER, DELAWARE.

(b) The District Engineer, U. S. Engineer Office, Philadelphia, Pa.

(c) Personnel of the U. S. Waterways Experiment Station.

(e) Experimental, for harbor improvements.

(f) To develop a plan which would eliminate or reduce shoaling in Wilmington Harbor, Del.

(g) Wilmington Harbor extends from the Delaware River to Lobdell Canal in the Christina River. The project provides for a channel 400 ft wide by 30 ft deep in the harbor and channels of varying dimensions through the City of Wilmington, Del., and on up the Christina River to Newport, Del., 9 miles above the mouth. Shoaling is very rapid in the harbor and is attributed to the very low current velocities that prevail. The model is of the fixed-bed, silt-injection type with scale ratios: horizontal dimensions, 1:800; vertical dimensions, 1:80. Included in the model are the Delaware River from 5 miles above Wilmington to Artificial Island, the Christina River from the mouth to the head of tidewater, and the Brandywine River from its mouth to the head of tidewater. Tides and currents are reproduced in the model by automatic tide gates, one at Artificial Island, and the other about 5 miles above Wilmington.

(h) Study completed. Final report: Tech. Memo. No. 194-1, "Model study of plans for elimination of shoaling in Wilmington Harbor, Delaware", available on loan.

ECOLE POLYTECHNIQUE DE MONTREAL, Hydraulics Laboratory, 1430 Rue Saint-Denis, Montreal 18, Canada.

MODEL TESTS OF SLUICE-GATE PIERS FOR LES FORGES.

(b) The Shawinigan Engineering Company, Ltd., Montreal.

(c) R. Boucher and assistants.

(d) Prof. Raymond Boucher, Ecole Polytechnique, 1430 Rue Saint-Denis, Montreal 18, Canada.

(e) Experimental research for design purposes.

(f) To determine (1) the discharge coefficient with free flow, and (2) the relation between the coefficient of discharge and the submergence ratio when drowning effect from tailrace level is produced.

(g) Three model piers (scale 1:78) were secured to the concrete floor of the 30-inch glass-sided flume, representing two full-gate and two half-gate openings. A simple rectangular tail-gate controlled the tailrace water elevation. All depths were referred to the elevation of the floor between the piers. Tests were made first with free flow to establish the discharge-head relationship. In the second series, a given free flow upstream depth was established and the tail-gate successively adjusted to give different ratios of downstream depth to upstream depth, from which was determined the variation of the coefficient of discharge in the general formula $Q = C\ b\ (H + V^2/2g)$ upstream.

(h) Project completed; report submitted to authority.

TESTS ON MODELS OF THE MONTMORENCY FALLS SPILLWAY DAMS.

(b) The Shawinigan Engineering Company, Ltd., Montreal.

(c) R. Boucher and assistants.

(d) Prof. Raymond Boucher, Ecole Polytechnique, 1430 Rue Saint-Denis, Montreal 18, Canada.

(e) Experimental project for design information.

(f) To determine flow conditions over two dams in series, the new one being placed downstream close to the toe of the old dam.

(g) Models to scale 1:30 of the old and proposed dams were installed close to each other in the 30-inch glass-sided flume, the old dam being placed upstream. Tests were made to obtain the discharge-head curves for various flow conditions over the old and the new dams in series, namely, old dam complete, old dam with 3 feet and 6 feet cut off the top part. Curves of discharge coefficient versus head were also determined for the new and old dams alone.

(h) Research completed and report submitted to the Shawinigan Engineering Company.

TRANSLATIONS

U. S. DEPT. OF THE INTERIOR, BUREAU OF RECLAMATION, Denver, Colo.

The following translations have been prepared by the Bureau of Reclamation. Inquiries should be addressed to the Chief Engineer, U. S. Dept. of the Interior, Bureau of Reclamation, Denver, Colo.

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U. S. WAR DEPT., CORPS OF ENGINEERS, U. S. WATERWAYS EXPERIMENT STATION, Vicksburg, Miss.

The following translations (except as otherwise noted) were made by Mr. H. B. Edwards, Engineer Department Research Centers, Vicksburg, Miss. Inquiries should be addressed to The Director, U. S. Waterways Experiment Station, P. O. Box 631, Vicksburg, Miss.

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COMMITTEES

FLUID MECHANICS COMMITTEE, Hydraulics Division, American Society of Civil Engineers.

Chairman, Dr. Hunter Rouse, State University of Iowa, Iowa City, Iowa.

The purpose of the committee is to further the advancement of hydraulics through coordination of endeavor with related fields of fluid mechanics. Initial projects consist of the following: (1) Sponsorship of a four-paper symposium on high-velocity flow in open channels; (2) listing of available motion pictures of flow phenomena for educational purposes; (3) making design data available for new laboratory and demonstration equipment: and (4) cooperation with proposed organization for publishing abstracts of papers on applied mechanics.

COMMITTEE ON HYDRAULIC RESEARCH, American Society of Civil Engineers.

Chairman, Prof. Boris A. Bakhmeteff, 250 West 57th St., New York 19, N. Y.

This committee was established in January 1946 for the purpose of developing fundamental research in civil engineering on the widest possible basis. This is in line with legislation now pending in Congress to establish a National Research Foundation. The committee has requested the cooperation of all hydraulic laboratories and research agencies in formulating plans to coordinate research and avoid duplication. A tentative list of what the committee considers to be fundamental and special research projects has been prepared, and suggestions and additions for improvement of the proposed program are invited. The committee also desires information regarding laboratory facilities and personnel available to conduct research programs along the lines suggested. The list of suggested projects and full information about this program may be obtained from Dr. Bakhmeteff at the above address.

RESEARCH COMMITTEES OF THE SECTION OF HYDROLOGY, AMERICAN GEOPHYSICAL UNION, 1530 P Street, N.W., Washington 5, D. C.

Reports of these committees are published annually in the Transactions of the American Geophysical Union.

SNOW	Mr. Richard C. Farrow, Chairman, Water Rights Branch, Parliament Buildings, Victoria, B. C., Canada.
GLACIERS	Mr. Francois E. Matthes, Chairman, U. S. Geological Survey, Washington 25, D. C.
PRECIPITATION	Mr. Merrill Bernard, Chairman, U. S. Weather Bureau, Washington 25, D. C.

RUNOFF	Mr. R. W. Davenport, Chairman, U. S. Geological Survey, Washington 25, D. C.
DYNAMICS OF STREAMS	Dr. Lorenz G. Straub, Chairman, St. Anthony Falls Hydraulic Laboratory, Hennepin Island, 3rd Avenue S.E., Minneapolis 14, Minn.

A report of the Sub-committee on Sediment Terminology, under the chairmanship of Mr. E. W. Lane, recommending terminology for sediments, will soon be published in the Transactions of the American Geophysical Union.

EROSION	Dr. W. C. Lowdermilk, Chairman, Soil Conservation Service, Washington 25, D. C.
EVAPORATION AND TRANSPIRATION	Mr. H. G. Wilm, Chairman, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
INFILTRATION	Mr. George W. Musgrave, Chairman, Soil Conservation Service, Washington 25, D. C.
PHYSICS OF SOIL MOISTURE	Dr. L. A. Richards, Chairman, U. S. Regional Salinity Laboratory, P. O. Box 672, Riverside, Calif.
UNDERGROUND WATER	Mr. S. W. Lohman, Chairman, U. S. Geological Survey, 351 Equitable Building, Denver 2, Colo.
PERMEABILITY	Mr. C. E. Jacob, Chairman, U. S. Geological Survey, Washington 25, D. C.
CHEMISTRY OF NATURAL WATERS	Dr. C. S. Howard, Chairman, U. S. Geological Survey, Albuquerque, N. Mex.
HYDROLOGIC REGIONS	Mr. Merrill Bernard, Chairman, U. S. Weather Bureau, Washington 25, D. C.
LAKES	Dr. Phil E. Church, Chairman, University of Washington, Seattle, Wash.

INTERNATIONAL ASSOCIATION FOR HYDRAULIC STRUCTURES RESEARCH

President, Dr. Wolmar Fellenius, Professor Emeritus at the Technical University of Stockholm, Sweden.

Secretary, Dr. J. Th. Thijsse, Professor and Director of the Hydraulic Laboratory at the Technical University of Delft, Holland.

After being virtually dormant for over six years because of the war, the Association has become reactivated, and plans have been made to hold its first post-war meeting in Stockholm, Sweden, in June 1948. The meeting will precede a meeting of the Congres des Grands Barrages which will be held in Stockholm the first half of June 1948, thus facilitating the possibility of participants of the Association meeting to attend the meeting of the Congres des Grands Barrages. Following the latter meeting, arrangements are in progress for excursions in Sweden to various dams and hydraulic works.

The last meeting of the Association was scheduled to be held in Liege in September 1939, but was called off less than a month before the scheduled date because of the break in international relations and the start of the World War. However, the reports and papers which were to be presented at the meeting were published in full in Stockholm in February 1940 and distributed to the members of the Association.

Applications for new members to the Association are being accepted. The Association consists of (1) individual members, and (2) corporative members.

(1) The individual membership may be obtained by anyone who is interested in hydraulic research if he is (a) professor in hydraulics or in a cognate branch of tuition at a technical university, at a university, or at another similar college; (b) director or employee with a leading situation at a hydraulic laboratory; (c) member of a leading scientific or technical association.

(2) The corporative membership is open for (a) institutions for hydraulic works or cognate ranges at a technical university, at a university, or at an equivalent college; (b) hydraulic laboratories; (c) national committees or analogical committees of the World Power Conferences, of the Congres des Grands Barrages, and of the Permanent International Association of Navigation Congresses; (d) public institutions which project, execute, and supervise hydraulic works.

The American Member of the Permanent Committee is Dr. Lorenz G. Straub, Director of the St. Anthony Falls Hydraulic Laboratory, University of Minnesota. Persons wishing to become members of the Association may communicate with him.

LABORATORY NOTES

UNIVERSITY OF ARKANSAS, Fayetteville, Ark.

G. P. Stocker, Dean, College of Engineering.

The College does not have enough teachers at the present time to do laboratory research of any kind. It is hoped that research can be resumed in the near future.

POLYTECHNIC INSTITUTE OF BROOKLYN, Brooklyn, N. Y.

Chilton A. Wright, Professor of Hydraulics and Sanitary Engineering.

At present, activities are largely confined to student thesis work and class instruction.

BYRON JACKSON COMPANY, P.O. Box 2017 Terminal Annex, Los Angeles 54, Calif.

D. H. Cooper, Chief Test Engineer.

During the past two years this company has been engaged in the design and construction of a new testing laboratory, the completion of which will initiate an accelerated program of research on centrifugal pumps and related products. The new laboratory will occupy 9000 square feet of floor space and have a reservoir capacity of 400,000 gallons. It will be equipped with vertical and horizontal General Electric DC dynamometers, 10 to 400 hp, 1500 to 4500 rpm. These incorporate selsyn speed-monitoring controls. Calibrated electric motors extend the range of power available to 3000 hp and the speed range down to 360 rpm. Venturis cover a range from 20 gpm to 50,000 gpm. Smaller sizes machined from 18-8 stainless steel forgings to extremely close tolerances incorporate new features believed to result in greater accuracy in flow measurement. Facilities are included for research and development of axial flow pumps. There will be oil reservoir capacity of 10,000 gpm for conducting research on the effsct of viscosity on centrifugal pumps. Instrumentation is not entirely complete and much of the detail will be developed after the laboratory is in operation.

UNIVERSITY OF CALIFORNIA, Department of Engineering, Los Angeles 24, Calif.

Prof. L. M. K. Boelter.

Since the start of instruction in the Engineering Department at Los Angeles about two years ago, no permanent facilities for hydraulic laboratory work have been constructed. One experimental project in cooperation with the U. S. Forest Service (reported under current projects) has been carried out with temporary facilities.

THE CATHOLIC UNIVERSITY OF AMERICA, Washington, D. C.

John B. Cotter, Asst. Professor of Mechanical Engineering.

The hydraulic laboratory has been transferred to the Department of Mechanical Engineering. No research work is anticipated at present because increased enrollment requires the full time and facilities of the department.

THE CLEMSON AGRICULTURAL COLLEGE, Clemson, S. C.

Prof. D. D. Curtis, Head, Department of Mechanics and Hydraulics.

Laboratory has not been active recently except for teaching purposes, but hopes to resume cooperative work and to engage in research in the near future.

COLORADO A & M COLLEGE, Fort Collins, Colo.

Robert L. Lewis, Head, Civil Engineering Department.

The name of this institution has been changed from Colorado State College of Agriculture to Colorado A & M College, and the former Department of Civil and Irrigation Engineering is now the Department of Civil Engineering. Activities in the field of hydraulics and irrigation are being increased.

COLUMBIA UNIVERSITY, New York, N. Y.

Victor Scottron, Asst. Professor of Mechanical Engineering.

Prof. Scottron has recently been designated head of the Worthington Hydraulics Laboratory to succeed Prof. Harry L. Parr, who retired in July 1946. Major changes in the laboratory are contemplated for the near future, but at present full attention is occupied with meeting student needs.

UNIVERSITY OF FLORIDA, College of Engineering, Gainesville, Fla.

Howard J. Hansen, Associate Professor of Civil Engineering.

The College is in the process of a large expansion program and at present is in the planning stage for hydraulic and hydrology research projects. It is hoped to have several projects under way by the middle of 1947.

UNIVERSITY OF IDAHO, Moscow, Idaho.

Allen S. Janssen, Acting Dean, College of Engineering.

The laboratory is new, and is now being equipped and staffed.

THE JAMES LEFFEL & COMPANY, Springfield, Ohio.

J. Robert Groff, President and General Manager.

This company has a turbine testing laboratory. Work has been curtailed because of the war, and there are no research projects to report at this time.

LOUISIANA STATE UNIVERSITY AND A & M COLLEGE, University Station, Baton Rouge 3, La.

Dr. Glen H. Cox, Head, Department of Hydraulic Engineering.

Research work was discontinued during the war, but it is hoped that by the coming year some projects will be under way.

UNIVERSITY OF MAINE, Orono, Maine.

H. D. Watson, Head, Mechanical Engineering Department.

No hydraulic research has been carried on during the past year because of the pressure of undergraduate class instruction.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Dept. of Civil and Sanitary Engineering, Cambridge 39, Mass.

Dr. Arthur T. Ippen, Associate Professor of Hydraulics.

The hydraulics laboratory at M.I.T. was closed all through the war. It was reopened in its old quarters during the spring of 1946, mainly for purposes of instruction and graduate research. The equipment and building have been renovated to a considerable extent during 1946, a new machine shop established, and office space provided.

Dr. A. T. Ippen, Associate Professor of Hydraulics, is in charge of the laboratory and instruction, aided by Dr. J. W. Daily, Assistant Professor of Hydraulics, and Associate Professor A. T. Gifford. Funds were provided by the administration for a permanent laboratory staff of one technical assistant and two mechanics.

Since it has long been realized that the housing of the laboratory is entirely inadequate, the work of the staff, in addition to teaching duties, is directed towards planning for a new laboratory building and construction of new equipment to be used in the new laboratory. It is expected that the plans may be realized as soon as construction costs have become stabilized and the necessary materials can be secured.

Plans for the new building provide for a large floor space to contain experimental research on hydrodynamic problems and model investigations, for a short towing tank for work in naval architecture, for a student laboratory containing a complete set of demonstration and experimental set-ups. In addition, the building will house extensive shops, storage and dark room facilities, a lecture and a reading room, a large drafting room, and a series of staff offices.

It is expected that several fundamental projects will be started during 1947 in cooperation with outside agencies and that a number of problems will be attacked experimentally by the staff and graduate students. The end of the year should see the old laboratory full of activity and the new hydrodynamics laboratory well on its way to provide extensive and modern facilities for research in most fields of fluid mechanics.

UNIVERSITY OF MICHIGAN, Dept. of Civil Engineering, Ann Arbor, Mich.

Prof. C. O. Wisler, Professor of Hydraulic Engineering.

The hydraulic engineering division of the Engineering College has just been granted funds with which to establish a Lake Hydraulics Laboratory, which will be provided with a wave machine and all equipment necessary for the study of waves, wave action, beach erosion, harbor improvement, and, in general, all lake hydraulics problems. Space has been provided and the equipment is now being ordered.

A description of the first project to be undertaken is given under Project No. 97, page 34, of this bulletin.

STATE OF NEW JERSEY, Division of Water Policy and Supply, 28 West State St., Trenton 8, N. J.

H. T. Critchlow, Chief Engineer.

The Division of Water Policy and Supply, Department of Conservation, was created last July as a result of the consolidation of various state organizations and is the successor of the former State Water Policy Commission. This Division exercises state jurisdiction over the diversion of water for public and potable purposes and over the construction of dams and structures within the natural high-water mark of streams.

NORTHWESTERN UNIVERSITY, The Technological Institute, Evanston, Ill.

Prof. M. B. Gamet, in charge of Hydraulic Laboratory.

Expansion of laboratory facilities is contemplated and as the graduate student enrollment increases, it is expected that the research program, other than that conducted solely by staff members, will become active.

THE UNIVERSITY OF OKLAHOMA, Norman, Okla.

W. H. Carson, Dean, College of Engineering.

The University of Oklahoma is planning to develop an extensive hydraulics laboratory and is looking for qualified engineering personnel to carry on research and to teach subjects related to fluid mechanics.

OREGON STATE COLLEGE, Corvallis, Ore.

C. A. Mockmore, Head, Dept. of Civil Engineering.

The hydraulic laboratory has been inactive, so far as research is concerned, since the war. There will be several graduate students this year, and it is hoped that the teaching schedule will be somewhat relieved from the rush of students so that research can again be resumed.

THE PELTON WATER WHEEL COMPANY, 19th and Alabama Streets, San Francisco 10, Calif.

P. B. Dawson, Jr., Section Engineer-Development.

740300 O - 47 - 11

The hydraulic laboratory has been expanded with increased facilities which include a 120-ft standpipe with overflow for constant head. Research projects are primarily for the development and test of new and improved products.

RENSSELAER POLYTECHNIC INSTITUTE, Troy, N. Y.

Prof. Grant K. Palsgrove, Dept. of Mechanical and Hydraulic Engineering.

No hydraulic research has been conducted during the past year, because the laboratories are undergoing complete overhauling.

THE ROCKY MOUNTAIN HYDRAULIC LABORATORY, Allenspark, Colo.

The Rocky Mountain Hydraulic Laboratory was established at Allenspark, Colo., in the summer of 1946. This laboratory is expected to serve the science of hydraulics in much the same way that the Marine Biological Station at Woods Hole, Mass., serves the natural sciences. The Allenspark Laboratory will operate only in the summer, and its primary purpose will be to facilitate research work of a fundamental nature in hydraulics and the related sciences. Students of hydraulics are welcome to join in the research and educational activities of the laboratory, which are under the direction of a board of trustees headed by Gerard H. Matthes. Personnel of the laboratory will include not only experienced investigators, but also young engineers interested in learning the techniques of hydraulic research. In addition to the experimental work, it is expected that lectures will be scheduled to take advantage of the presence of well-known authorities. The laboratory is a non-profit organization. Expenses will be met by donations, grants for the conduct of research, and fees for the use of its facilities.

At the start of the first season the principal asset of the organization was its 20-acre site which, though totally unimproved, included a quarter-mile reach of the North St. Vrain Creek flowing more than 25 cfs of crystal-clear water, with a total fall of nearly 80 feet. The laboratory will have an available head of 60 feet and a discharge of 75 cfs when completed.

At the end of the first season, a shop building 18 by 40 feet had been erected, with sleeping quarters for two students. More space will be available next summer, and there are rental cabins and hotels in nearby Rocky Mountain National Park. Every effort will be made to accommodate all those who signify their desire to participate in the laboratory's program.

As yet no reports have been written as a result of the work at the laboratory. A successful method of washing local sand deposits to free the sand from heavy tannic acid content has been developed. Some work has been done on the formation of vortices on the upstream edge of boulders in a natural stream and the resulting formation of potholes and flutes. This work is being done by G. H. Matthes and John H. Dawson.

Persons who wish to participate in the laboratory's program, or who would like to use its facilities for research on a particular project, should communicate with Prof. R. W. Powell, The Ohio State University, Columbus 10, Ohio; Prof. C. J. Posey, State University of Iowa, Iowa City, Iowa; or Prof. John H. Dawson, University of Colorado, Boulder, Colo.

STEVENS INSTITUTE OF TECHNOLOGY, Experimental Towing Tank, 711 Hudson St., Hoboken, N. J.

Kenneth S. M. Davidson, Director.

The Experimental Towing Tank at Stevens Institute of Technology has now completed ten years of activity. In 1932 and 1933, intermittent experimental work was carried out in the Stevens swimming pool on models of sailing yachts towed from a stretched wire. Construction of a 100-ft tank was completed in 1935, and while the bulk of work continued to be on sail-driven yachts, power-driven hulls began to assume a more prominent place in the Tank's activities, as shown by the fact that in 1938, 33 of the 79 models investigated were of power-driven types.

Because of the experience provided by this work, the Tank was able in 1940 to accept contracts from the Navy Department and the National Advisory Committee for Aeronautics. There was a rapid expansion of activities due to the war, and Tank No. 2 was built in 1942. Since that time, the Tank has carried out several hundred distinct projects of varying size, involving hydrodynamic investigations of ships, aircraft, and other bodies. The

bulk of these projects was for the Army, Navy, and Office of Scientific Research and Development, and was almost exclusively of a classified nature. The projects ranged from basic research on steering and turning of ships to problems of a purely development nature. Tank No. 3, 300-ft long, 12-ft wide, and 6-ft deep, was completed in 1944. In addition, a rotating arm in Tank No. 2, the 75-ft square maneuvering tank, was installed. This apparatus is the only one of its kind in this country, and only one other, in Paris, is known to exist in the world.

At the present time the Tank is working on Project No. 721, so there has been an average of 72 new projects per year for the ten year period. The number of models represented by these projects is approximately 750, since many projects require several modifications of the basic model.

Results of the work are recorded in about 300 Technical Reports, 80 Technical Memoranda, and 30 Technical Notes. Technical Reports present the results of work done on a specific project, and generally are not published or made available except with permission of the client. A number have been published as reports of the National Advisory Committee for Aeronautics or of the Navy Department. Technical Memoranda present discussions or analyses of trends or developments revealed by series of tests or the work of other establishments. Unless on a classified subject, they are available to anyone interested. Technical Notes cover any subject which cannot properly be considered material for a Technical Report or Memorandum.

With the close of the war, the Tank returned to more normal working conditions. At present it is occupied principally by long range projects. Attention is being given to the establishment of a course in hydrodynamics, possibly for graduate students only and in conjunction with their studies at Stevens Institute of Technology or other nearby colleges and universities.

A comprehensive outline of the scope of the activities of the Tank may be had by referring to "The Experimental Towing Tank Ten Year Report", Stevens Institute of Technology, Hoboken, N. J.

SYRACUSE UNIVERSITY, Syracuse 10, N. Y.

Louis Mitchell, Dean, L. C. Smith College of Applied Science.

No research is being carried on in the hydraulic laboratory at the present time, because of increased enrollment and needs of students.

THE UNIVERSITY OF TENNESSEE, Knoxville 16, Tenn.

Cecil S. Camp, Associate Professor of Hydraulic and Sanitary Engineering.

The hydraulic laboratory is just getting back into its graduate program and has not yet commenced work on any research projects.

TEXAS A & M COLLEGE, Engineering Experiment Station, College Station, Tex.

A. Cecil Wamble, Acting Vice-Director.

The hydraulic laboratory is now inactive, due to personnel shortages. Research will be resumed when appointment is made of someone to head this work.

THE STATE COLLEGE OF WASHINGTON, Pullman, Wash.

Prof. Charles L. Barker, Associate Professor of Hydraulic Engineering.

The State College of Washington has been building a new hydraulics laboratory. Although not yet completed, it is being used for undergraduate instruction. In it are performed experiments of flow of oils and gases, as well as water. The laboratory pumping capacity is approximately 1000 gpm. In addition, equipment is available so that experimental work on high heads up to 800 feet can be carried on. Because of the construction program, no research has been carried on.

WAYNE UNIVERSITY, Detroit 1, Mich.

Prof. Dudley Newton, Chairman, Department of Civil Engineering.

Wayne University expects to have a new engineering building which will include a worth-while hydraulic laboratory, within the next two or three years. At present there is only make-shift equipment for students to conduct hydraulic experiments.

NO REPORT

Because of disruption of activities due to the war, the present heavy student enrollment, or other reasons, the following laboratories have no research activities to report at this time:

University of Alaska, College, Alaska.
Dartmouth College, Thayer School of Engineering, Hanover, N. H.
The George Washington University, Civil Engineering Dept., Washington, D. C.
Lafayette College, Civil Engineering Dept., Easton, Pa.
New York University, College of Engineering, University Heights, N. Y.
Oklahoma A & M College, Division of Engineering, Stillwater, Okla.
The University of Rochester, Division of Engineering, Rochester, N. Y.
Union College, Schenectady, N. Y.
Yale University, School of Engineering, New Haven, Conn.

U. S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, Washington 25, D. C.

Lewis A. Jones, Chief, Division of Drainage and Water Control.

The Hydrologic Division, the Sedimentation Division, and the Drainage Division of the Soil Conservation Service have been combined into the Division of Drainage and Water Control.

The Spartanburg Outdoor Hydraulic Laboratory was discontinued about 1940.

The Irrigation Research Laboratory at Logan, Utah, was completed about a year ago and has been in operation only a few months.

U. S. DEPT. OF COMMERCE, NATIONAL BUREAU OF STANDARDS, Washington 25, D. C.

Herbert N. Eaton, Chief, National Hydraulic Laboratory.

The National Hydraulic Laboratory was shut down early in 1943 because its facilities and personnel were needed for the development of an ordnance project of high priority for the Armed Services. No research work in hydraulics was carried on after that date. The laboratory is now being reconverted and research and testing are being gradually resumed. Some time will be required for complete rehabilitation of the building and equipment and it will probably be another six months before the laboratory will be in full operation.

U. S. DEPT. OF THE INTERIOR, BUREAU OF RECLAMATION, Denver, Colo.

R. F. Blanks, Chief, Engineering and Geological Control and Research Division.

During the past year the Bureau of Reclamation laboratories were moved from the Customhouse to new and larger quarters at the Denver Federal Center. The hydraulic laboratory has approximately 70,000 square feet of floor space, exclusive of office facilities, in a converted small-arms manufacturing building at the Federal Center. On the same reservation a 60-acre tract has been set aside for extensive river-flow hydraulic laboratory investigations. With the expansion of the hydraulic laboratory into its new quarters, the auxiliary photographic and electronic instrumentation laboratories have been enlarged to keep hydraulic laboratory practice abreast of theory.

It is possible that considerable data will be accumulated in the field on the general subject of model-prototype agreement in the next year or so, inasmuch as several hydraulic structures now under construction have been especially equipped for convenient observation of hydraulic phenomena.

TENNESSEE VALLEY AUTHORITY, Norris, Tenn.

G. H. Hickox, in charge, Hydraulic Laboratory.

Because of the pressure of work, it has not been possible for this laboratory to list and describe the many projects which have been initiated and completed since the issuance of the last bulletin, as well as projects now current. The laboratory is very active, and it is hoped that a report on its activities will be included in the next issue of the bulletin.

U. S. WAR DEPT., CORPS OF ENGINEERS, Portland, Ore.

The District Engineer, Portland District.

The Bonneville Hydraulic Laboratory decreased its activities subsequent to the issue of our last bulletin (Volume X), and by July 1944 had become altogether

inactive. In April 1945 operations were resumed, with special attention being given to the revised spillway of Dorena Dam and the McNary project. The laboratory functions at Bonneville as a subsectional unit of the Portland District organization.

McGILL UNIVERSITY, Montreal, Canada.

Dean R. E. Jamieson, Chairman, Dept. of Civil Engineering.

Because of the large number of students, the resources of the hydraulic laboratory are taxed to capacity for undergraduate teaching. Research is carried on by students for master's degree, and some research on a small scale is done for industrial concerns, such as investigations in water-hammer in pipes, tests of hydraulic models including turbine runners, etc.

THE SHAWINIGAN WATER AND POWER COMPANY, P.O. Box 6072, Montreal, Canada.

M. Balls

Experimental hydraulic installation was inactive during the war, and at present no hydraulic studies are contemplated.

EUROPEAN AND ASIATIC LABORATORIES.

LABORATOIRE DE CHATOUX, FRANCE.

M. A. Nizery, Chief Engineer, Ponts et Chaussees, 199 rue de Grenelle, Paris VII, France.

A new French hydraulic laboratory at Chatoux, about 10 kilometers from Paris, is being planned by the society, L'Electricite de France, Service National, an organization comprising all of the societies in France for the production and distribution of electricity. It will have a staff of about fifty persons and will be occupied with problems in the fields of reduced-scale models of hydraulic structures, river control problems, harbor problems, and problems of general interest.

Through the courtesy of Prof. ir. J. Th. Thijsse, Director of the Hydraulic Laboratory at the Technical University of Delft, Holland, it has been learned that the following laboratories are now in operation. This list probably is incomplete.

BELGIUM	Laboratoire de Recherches Hydrauliques, Berchemlei 115, Anvers (Borgerhout) Belgium (J. Lamoen, Director)
	Laboratorium voor Hydraulica der Universiteit, St. Pietersnieuwstraat 69, Ghent, Belgium (L. J. Tison, Director)
	Laboratoire d'Hydraulique Fluviale de la Faculté des Sciences appliquées de l'Université de Liège, Quai de Rome 139, Liège, Belgium (F. Campus, Director)
CZECHOSLOVAKIA	Státni ústavy hydrologicky a hydrotechnicky T. G. Masaryka, Podbaba, Praha, Czechoslovakia (J. Smetana, Director)
FRANCE	Laboratoire Central d'Hydraulique, Charenton près Paris, France (J. Laurent, Director)
	Laboratoire Dauphinois d'Hydraulique, Ateliers Neyret-Beylier et Picard-Pictet, Grenoble (Isère) France (P. Danel, Director)

FRANCE (cont'd)	Laboratoire de l'Ecole des Ingénieurs hydrauliciens, Grenoble (Isère) France (P. Danel, Director)
	L'institut Electrotechnique et de Mécanique appliquée de l'Université de Toulouse, Toulouse, France (L. Escande, Director)
	Laboratoire de la Société Hydrotechnique de France, Chatoux, France
GREAT BRITAIN	The Whitworth Engineering Laboratories, Victoria University, Manchester, England (A. H. Gibson, Director)
	National Physical Laboratory, Engineering Division, Teddington, England (G. A. Hankins and L. E. Prosser, Directors)
	Hydraulics Laboratory, Imperial College, University of London, Exhibition Road, South Kensington, London, England (C. M. White, Director)
ITALY	Instituto di Idraulica e Construzioni Idrauliche, Piazza Leonardo da Vinci 32, Milan, Italy (G. de Marchi, Director)
	Instituto di Idraulica de la Universita di Pisa, Via Diotisalvi, Pisa, Italy (A. Rastrelli, Director)
THE NETHERLANDS	Waterloopkundig Laboratorium, Raam 61, Delft, The Netherlands (J. Th. Thijsse, Director)
SWEDEN	Vattenbyggnadslaboratoriet vid Kungl. Tekniska Högskolan, Valhallavägen, Stockholm, Sweden (B. Hellström, Director)
	Vattenbyggnadsbyrån, Humlegårdsgatan 29, Stockholm, Sweden (P. G. Hörnell, Director)
SWITZERLAND	Laboratoire d'Hydraulique de l'Ecole d'Ingénieurs de l'Université de Lausanne, Rue de Geneve 67, Lausanne, Switzerland (A. Stucky, Director)
INDIA	Punjab Irrigation Research Institute, Lahore, India (H. L. Uppal, Director)
	Central Irrigation Hydrodynamic Research Station, Poona, India (K. K. Framje, Director)
INDONESIA	Waterloopkundig Laboratorium, Bandoeng, Java Temporary address: Mijnbouwstraat 5, Delft, Holland (H. Vlugter, Director)
SYRIA	Laboratoire d'Hydraulique de l'Ecole Francaise d'Ingénieurs de Beyrouth, Beyrouth, Syria (E. Crausse, Director)

SUBJECT INDEX OF PROJECTS

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